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Nuclear Science Abstracts

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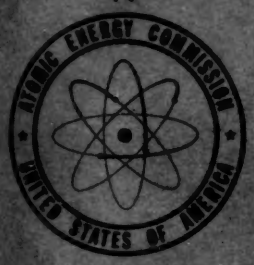
Mar. 31, 1954



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GUIDE TO ABSTRACT WRITING

INTRODUCTION TO

NUCLEAR SCIENCE ABSTRACTS

A Publication of the United States Atomic Energy Commission Technical Information Service

The printing of this publication has been approved by
The Director of the Bureau of the Budget August 2, 1951

Nuclear Science Abstracts is issued twice a month throughout the calendar year by the Atomic Energy Commission. It is intended primarily to serve scientists and engineers working within the Atomic Energy Project by abstracting as completely and as promptly as possible the literature of nuclear science and engineering. It covers not only the unclassified and declassified research reports of the Atomic Energy Commission and its contractors, but also material in its field of interest which appears in technical and scientific journals and unpublished research reports of government agencies, universities, and industrial research establishments.

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The issuance of these Abstracts does not constitute authority for declassification of any reports.

INDEXES

Nuclear Science Abstracts is indexed by author, subject, and report number. Annual index issues are prepared for each volume, and the next cumulated index will appear in volume 10(1956) covering volumes 5-10. A cumulated index to volumes 1-4 was issued as volume 4, No. 24B, Dec. 30, 1950 covering authors, subjects, nuclides, and report numbers. The 24th number of volumes 5, 6, and 7 contain indexes covering the individual volumes and a cumulated Numerical Index of Reports covering Abstracts of Declassified Documents, Vols. 1 and 2, as well as the previously issued NSA volumes.

Each issue of Vol. 8(1954) contains an author index to abstracts in that issue and a regularly cumulated supplement to the Numerical Index of Reports. Subject and author indexes, covering three-, six-, and nine-month periods, are issued as supplements to the sixth, twelfth, and eighteenth issues. The 24th issue is the annual index for the volume.

AVAILABILITY

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NUCLEAR SCIENCE ABSTRACTS

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CALENDAR OF MEETINGS

Suggestions for additions to this list will be welcomed and should be sent with all pertinent information to the Cataloging Branch, Technical Information Service, U. S. Atomic Energy Commission, P. O. Box 62, Oak Ridge, Tennessee.

June 20-25, 1954

NUCLEAR ENGINEERING CONFERENCE, University of Michigan, Ann Arbor, Michigan, Sponsored by: American Institute of Chemical Engineers.

Inquiries should be addressed to: Professor Donald Katz, University of Michigan, Department of Engineering, Ann Arbor, Michigan.

July 19-24, 1954

SECOND RADIOISOTOPE CONFERENCE (a conference on the peaceful uses of atomic energy), Oxford, England,
Arranged by: The Atomic Energy Research Establishment, Harwell.

Inquiries should be addressed to: The Conference Secretary, Atomic Energy Research Establishment, Harwell, Didcot, Berks, England.

SELECTED SUBJECTS OF INTEREST TO INDUSTRY

All AEC reports abstracted in this issue of Nuclear Science Abstracts have been reviewed and evaluated in terms of their interest and usefulness to general industry. These reports are listed below by title, author, and report number under one or more of the following nine broad categories: Chemistry and Chemical Engineering; Construction and Civil Engineering; Electronics and Electrical Engineering; Health and Safety; Industrial Management; Mechanics and Mechanical Engineering; Metallurgy and Ceramics; Mining and Geology; and Nuclear Technology. The abstract number for each report is listed at the upper right of the entry and refers to an item in the current issue of NSA.

All unclassified reports considered to be of special interest to general industry issued by the AEC prior to July, 1953 are listed or abstracted in a series of bibliographies (TID-3050), the titles of which correspond to the above-mentioned categories. As these background bibliographies become available for sale, the prices will appear in the Numerical Index of Reports which is included in each issue of this volume of NSA. These bibliographies may be purchased from the U. S. Department of Commerce, Office of Technical Services, Washington 25, D. C.

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CHEMISTRY AND CHEMICAL ENGINEERING

AECU-2737 1537
Stanford Research Inst.
CONTINUOUS COUNTERCURRENT ION EXCHANGE WITH TRACE COMPONENTS. TECHNICAL REPORT NO. 5. Nevin K. Hiester, Earl F. Fields, Russell C. Phillips, and Shirley B. Radding. June 24, 1953. 56p. Contract AT (11-1)-110, Report No. 30. (AECU-2737)

AECU-2738 1538
Stanford Research Inst.
COUNTERCURRENT ION EXCHANGE WITH GROSS COMPONENTS. PART 1. IN AN EQUILIBRIUM STAGE CONTACTOR. PART 2. IN A CONTINUOUS COUNTERCURRENT COLUMN. TECHNICAL REPORT NO. 6. Nevin K. Hiester, Russell C. Phillips, and Raymond K. Cohen. June 25, 1953. 68p. Contract AT(11-1)-110, Report No. 31. (AECU-2738)

AECU-2741 1539
Stanford Research Inst.
ANALYTICAL METHODS USED IN THE STUDIES ON CONTINUOUS SEPARATION OF IONS BY COUNTERCURRENT ION EXCHANGE. TECHNICAL REPORT NO. 4. Nevin K. Hiester, Russell C. Phillips, Shirley B. Radding, and Oliver D. Smith. Apr. 10, 1953. 30p. Contract AT(11-1)-110, Report No. 27. (AECU-2741)

AECU-2742 1540
Stanford Research Inst.
COUNTERCURRENT ION EXCHANGE. FINAL SUMMARY REPORT. Nevin K. Hiester and Russell C. Phillips. June 30, 1953. 9p. Contract AT-(11-1)-110, Report No. 34. (AECU-2742)

AECU-2756 1552
Johns-Manville Corp.
THERMAL INSULATION DEVELOPMENT. HEAT LOSS FROM SIR MARK A PIPING DUE TO PIPE HANGER AND CALROD PENETRATIONS THROUGH LK INSULATION. (SUPPLEMENTAL REPORT). S. Speil. Nov. 30, 1953. 4p. Contract AT(36-1)-8. (AECU-2756)

AECU-2785 1619
Los Alamos Scientific Lab.
STATISTICAL UNCERTAINTIES IN THE RADIOGRAPHIC DETERMINATION OF GAS DENSITIES. Douglas Venable and Leo F. Perry. Dec. 1953. 18p. Contract [W-7405-eng-36]. (AECU-2785)

AECU-2787 1511
Los Alamos Scientific Lab.
CATALYSIS BY Pt(III) OF EXCHANGE REACTIONS OF $PtCl_4^=$ AND $PtCl_6^=$. Ronald L. Rich and Henry Taube. [1953] 12p. (AECU-2787)

ANL-5173 1546
Argonne National Lab.
ABSORPTION SPECTRA OF URANYL COMPOUNDS IN SOLUTION. Eugene Rabinowitch. Dec. 1953. 76p. Contract W-31-109-eng-38. (ANL-5173)

ANL-5184 1526
Argonne National Lab.
A MODIFIED RADIOCHEMICAL STRONTIUM PROCEDURE. Elton Turk. Dec. 1953. 8p. Contract W-31-109-eng-38. (ANL-5184)

COO-1011 1541
Illinois Univ. Engineering Experiment Station
REMOVAL OF NITROGEN OXIDES FROM GASEOUS MIXTURES. TECHNICAL REPORT NO. 10. M. S. Peters, C. P. Ross, and L. B. Andersen. Sept. 30, 1953. 107p. Contract AT(30-3)-28. (COO-1011)

HW-30066 1559
Hanford Works
EVALUATION OF A METHOD OF DETECTING ANODIC

AND CATHODIC AREAS ON ALUMINUM SURFACES. R. E. Wilson. Nov. 23, 1953. 18p. Contract W-31-109-eng-52. (HW-30066)

ISC-433 1535
Ames Lab.
THE USE OF COPPER AS THE RETAINING ION IN THE ELUTION OF RARE EARTHS WITH AMMONIUM ETHYLENEDIAMINE TETRAACETATE SOLUTIONS. F. H. Spedding, J. E. Powell, and E. J. Wheelwright. Dec. 8, 1953. 13p. Contract W-7405-eng-82. (ISC-433)

ISC-436 1609
Ames Lab.
TRANSMISSION OF 0-40 KEV ELECTRONS BY THIN FILMS WITH APPLICATION TO BETA-RAY SPECTROSCOPY. R. O. Lane and D. J. Zaffarano. [Jan. 7, 1954] 21p. Contract W-7405-eng-82. (ISC-436)

ISC-437 1515
Ames Lab.
CAUSTIC TREATMENT OF ZIRCON SAND. G. H. Beyer, D. R. Spink, J. B. West, and H. A. Wilhelm. [Dec. 28, 1953]. 15p. Contract W-7405-eng-82. (ISC-437)

K-1080 1560
Carbide and Carbon Chemicals Co. (K-25)
METAL MATERIALS FOR HANDLING AQUEOUS HYDROFLUORIC ACID. M. Schussler, A. G. Dobbins, and D. S. Napolitan. Issued Dec. 7, 1953. 70p. Contract W-7405-eng-26. (K-1080)

KAPL-999 1629
Knolls Atomic Power Lab.
SOME COMMENTS ON THE MASS SPECTROMETRIC ANALYSIS OF THE ISOTOPES OF LITHIUM USING A SURFACE IONIZATION SOURCE. T. L. Collins and F. M. Rourke. Nov. 9, 1953. 22p. Contract W-31-109-Eng-52. (KAPL-999)

LA-1600 1582
Los Alamos Scientific Lab.
EXPERIMENTAL STUDIES OF TAYLOR INSTABILITY. John C. Allred, George H. Blount, and John H. Miller, III. Nov. 1953. 72p. Contract W-7405-eng-36. (LA-1600)

NYO-3101 1517
Columbia Univ.
VAPOR PRESSURE OF SODIUM. PROGRESS REPORT. M. M. Makansi, C. H. Muendel, and W. A. Selke. Dec. 1, 1953. 6p. Contract AT(30-1)-1101. (NYO-3101)

NYO-6096 1547
Clarkson Coll. of Tech.
PERFORMANCE OF PACKED COLUMNS. [PART] 1. TOTAL, STATIC, AND OPERATING HOLDUPS. H. L. Shulman, C. F. Ullrich, and N. Wells. Jan. 8, 1954. 44p. Contract AT(30-1)-1463. (NYO-6096)

NYO-6097 1548
Clarkson Coll. of Tech.
PERFORMANCE OF PACKED COLUMNS. [PART] 2. WETTED AREAS, EFFECTIVE INTERFACIAL AREAS, GAS PHASE MASS TRANSFER RATES (k_G) AND LIQUID PHASE MASS TRANSFER RATES (k_L). H. L. Shulman, C. F. Ullrich, A. Z. Proulx, and J. O. Zimmerman. Jan. 8, 1954. 54p. Contract AT(30-1)-1463. (NYO-6097)

NYO-6346 1518
Pittsburgh Univ.
THE INFLUENCE OF STRUCTURE ON THE STABILITY OF CHELATES OF SOME SUBSTITUTED 8-HYDROXYQUINOLINES AND ANALOGOUS REAGENTS (thesis). William Dwight Johnston. 1953. 165p. (NYO-6346)

NYO-6347 1542
Pittsburgh Univ.
ACETYLACETONE AS AN ANALYTICAL EXTRACTION AGENT (thesis). John Franklin Steinbach. 1953. 127p. (NYO-6347)

ORNL-1602 1620
Oak Ridge National Lab.
DEVELOPMENT OF THE PIPE-LINE GAS SEPARATOR. J. A. Hafford. Issued Nov. 2, 1953. Decl. Jan. 14, 1954. 22p. Contract W-7405-eng-26. (ORNL-1602)

ORNL-1623 1527
Oak Ridge National Lab.
DETERMINATION OF THE ALKALI METALS BY NEUTRON ACTIVATION ANALYSIS. G. W. Leddicotte and S. A. Reynolds. Issued Oct. 21, 1953. Decl. Jan. 7, 1954. 17p. Contract W-7405-eng-26. (ORNL-1623)

ORNL-1652 1624
Oak Ridge National Lab.
ISOTOPIC ABUNDANCES OF PALLADIUM. J. R. Sites, George Consolazio, and Russell Baldock. Dec. 7, 1953. 11p. Contract W-7405-eng-26. (ORNL-1652)

ELECTRONICS AND ELECTRICAL ENGINEERING

AECU-2789 1631
Los Alamos Scientific Lab.
LARGE-VOLUME LIQUID SCINTILLATORS AND THEIR APPLICATIONS. C. L. Cowan, F. B. Harrison, and F. Reines. [1953?]. 18p. Contract W-7405-eng-36. (AECU-2789)

AECU-2790 1581
Los Alamos Scientific Lab.
COMPARISON OF INDUCTANCE OF ELECTRICALLY SHORT TRANSMISSION LINES. Douglas Venable, Charles F. Beckett, and Clarence J. Brown. [1953?] 5p. Contract W-7405-eng-36. (AECU-2790)

COO-1012 1550
Illinois Univ. Engineering Experiment Station
COLLECTION OF AEROSOLS BY FIBER MATS. TECHNICAL REPORT NO. II. J. B. Wong and H. F. Johnstone. Oct. 31, 1953. 108p. Contract AT(30-3)-28. (COO-1012)

HW-29478 1666
Hanford Works
A PORTABLE METEOROLOGICAL MAST. P. W. Nickola and R. G. Clark. Sept. 30, 1953. 29p. Contract W-31-109-Eng-52. (HW-29478)

HW-29732 1633
Hanford Works
AN IONIZATION CHAMBER METHOD FOR ABSOLUTE GAMMA RAY DOSE MEASUREMENTS. I. T. Myers. Oct. 14, 1953. 30p. Contract W-31-109-Eng-52. (HW-29732)

MLM-857 1634
Mound Lab.
A WINDOWLESS PROPORTIONAL CHAMBER FOR ABSORPTION MEASUREMENTS. (INFORMATION REPORT). L. B. Gnagey. May 15, 1953. 8p. Contract AT-33-1-GEN-53. (MLM-857)

MTA-39 1621
Livermore Research Lab., Calif. Research and Development Co.
AN AUTOMATIC SWEEP UNIT FOR SINGLE CHANNEL PULSE HEIGHT ANALYZERS. G. D. O'Kelley. Issued Oct. 1953. 15p. Contract AT(11-1)-74. (MTA-39)

ORNL-1660 1551
Oak Ridge National Lab.
A SERVOMECHANISM FOR MEASURING AEROSOL PARTICLE SIZE AND A SERVOMECHANISM FOR CONTROLLING PARTICLE SIZE IN THE DIOCTYL PHTHALATE AEROSOL GENERATOR. R. Louis Bradshaw. Issued Jan. 29, 1954. 36p. Contract W-7405-eng-26. (ORNL-1660)

UCLA-275 1496
Atomic Energy Project, Univ. of Calif., Los Angeles
PRODUCTION OF HIGH SPEED LIQUID JETS BY MEANS OF A PROPELLANT. Brian Dunne, Jr., Herbert Gass, and Benedict Cassen. Issued Jan. 10, 1954. 19p. Contract AT-04-1-GEN-12. (UCLA-275)

UCRL-2251 1606
Radiation Lab., Univ. of Calif., Berkeley
FORMATIVE TIME DELAY OF HIGH-VACUUM SPARKS. Harry G. Heard. Nov. 6, 1953. 24p. Contract W-7405-eng-48. (UCRL-2251)

HEALTH AND SAFETY

ANL-5168 1632
Ansco Div., General Aniline and Film Corp.
DEVELOPMENT OF A WAVELENGTH-INDEPENDENT RADIATION MONITORING FILM. FINAL REPORT. Aug. 1, 1953. 68p. Contract [W-31-109-eng-38], Subcontract 31-109-38-139. (ANL-5168)

HW-29478 1666
Hanford Works
A PORTABLE METEOROLOGICAL MAST. P. W. Nickola and R. G. Clark. Sept. 30, 1953. 29p. Contract W-31-109-Eng-52. (HW-29478)

UR-266 1507
Atomic Energy Project, Univ. of Rochester
POLONIUM IN THE URINE OF MINERS EXPOSED TO RADON. Mary Sultzer and J. B. Hursh. Dec. 7, 1953. 28p. Contract W-7401-eng-49. (UR-266)

UR-294 1504
Atomic Energy Project, Univ. of Rochester
ATMOSPHERIC MONITORING FOR ALPHA EMITTERS USING MOLECULAR FILTER MEMBRANES. Thomas T. Mercer. Jan. 4, 1954. 24p. Contract W-7401-eng-49. (UR-294)

MECHANICS AND MECHANICAL ENGINEERING

AECU-2756 1552
Johns-Manville Corp.
THERMAL INSULATION DEVELOPMENT. HEAT LOSS FROM SIR MARK A PIPING DUE TO PIPE HANGER AND CALROD PENETRATIONS THROUGH LK INSULATION. (SUPPLEMENTAL REPORT). S. Speil. Nov. 30, 1953. 4p. Contract AT(36-1)-8. (AECU-2756)

METALLURGY AND CERAMICS

AECU-2780 1570
Institute of Engineering Research, Univ. of Calif., Berkeley
FUNDAMENTALS OF GLASS TO METAL BONDING. TECHNICAL REPORT NO. 3. WETTABILITY OF ADDITIONAL METALS BY SODIUM SILICATE GLASS. David W. Mitchell, Joseph A. Pask, and Alexander Kaminski. June 1, 1953. 17p. Contract AT-(11-1)-34. (AECU-2780)

BMI-888 1571
Battelle Memorial Inst.
FABRICATION AND EVALUATION OF THIN CLAD SHEETS OF MOLYBDENUM. M. H. LaChance, C. M. Craighead, and R. I. Jaffee. Nov. 2, 1953. 40p. Contract W-7405-eng-92. (BMI-888)

BMI-891 1558
Battelle Memorial Inst.
SOLUBILITY OF THE PRODUCTS OF CORROSION OF STAINLESS STEEL IN 600 F WATER. H. A. Pray and E. F. Stephan. Nov. 30, 1953. 12p. Contract W-7405-eng-92. (BMI-891)

DP-13 1554
DuPont de Nemours, E. I., and Co. Explosives Dept., Atomic Energy Div.
EDDY-CURRENT INSPECTION METHODS: TRIP REPORT—THE DR. FÖRSTER INSTITUTE, REUTLINGEN, GERMANY. R. C. McMillen. Nov. 1953. 46p. Contract AT(07-2)-1. (DP-13)

HW-30066 1559
Hanford Works
EVALUATION OF A METHOD OF DETECTING ANODIC AND CATHODIC AREAS ON ALUMINUM SURFACES. R. E. Wilson. Nov. 23, 1953. 18p. Contract W-31-109-eng-52. (HW-30066)

ISC-434 1572
Ames Lab.
MEASUREMENT OF THE ELECTRICAL RESISTANCE OF METALS AND ALLOYS AT HIGH TEMPERATURES. Premo Chiotti. Dec. 28, 1953. 25p. Contract W-7405-eng-82. (ISC-434)

LRL-74 1561
Livermore Research Lab., Calif. Research and Development Co.
AQUEOUS STATIC CORROSION OF ALUMINUM ALLOYS COUPLED TO STAINLESS STEEL AND ZIRCONIUM AT 350°F. P. O. Strom, M. H. Boyer, and L. M. Litz. Jan. 1954. 14p. Contract AT(11-1)-74. (LRL-74)

NYO-3101 1517
Columbia Univ.
VAPOR PRESSURE OF SODIUM. PROGRESS REPORT. M. M. Makansi, C. H. Muendel, and W. A. Selke. Dec. 1, 1953. 6p. Contract AT(30-1)-1101. (NYO-3101)

NYO-6289 1556
Massachusetts Inst. of Tech.
STUDY OF METAL-CERAMIC INTERACTIONS AT ELEVATED TEMPERATURES. F. H. Norton, W. D. Kingery, F. A. Halden, and M. Berg. Sept. 30, 1953. 37p. Contract AT(30-1)-1192. (NYO-6289)

NYO-6291 1557
Massachusetts Inst. of Tech.
STUDY OF METAL-CERAMIC INTERACTIONS AT ELEVATED TEMPERATURES. PROGRESS REPORT [FOR APRIL 1 THROUGH JUNE 30, 1953]. F. H. Norton, W. D. Kingery, et al. July 1, 1953. 6p. Contract AT-(30-1)-1192. (NYO-6291)

NUCLEAR TECHNOLOGY

NEPA-1446 1690
NEPA Div. Fairchild Engine and Airplane Corp.
CALIBRATING OF THE NEPA STANDARD PILE. Fred Maienschein and William B. Baker. June 16, 1950. 31p. [Contract W-33-08-ac-14801 (16250)]. (NEPA-1446)

NUCLEAR SCIENCE ABSTRACTS

Vol. 8 Mar. 31, 1954 No. 6A

An asterisk preceding the abstract number indicates that the corresponding report is included in the "Selected Subjects of Interest to Industry" section of this issue.

BIOLOGY AND MEDICINE

*1496

Atomic Energy Project, Univ. of Calif., Los Angeles

PRODUCTION OF HIGH SPEED LIQUID JETS BY MEANS OF A PROPELLANT. Brian Dunne, Jr., Herbert Gass, and Benedict Cassen. Issued Jan. 10, 1954. 19p. Contract AT-04-1-GEN-12. (UCLA-275)

Supersonic liquid jets were produced in air by ejecting the fluid through a small orifice with a high pressure developed from the decomposition of a heat-sensitive propellant. By this means, jets having velocities up to 1.75 times the speed of sound in air have been obtained, compared with about 1.3 for mechanical injectors. The maximum pressure attained by this method is estimated to be approximately 75,000 lb/in.^{2}. The jets produced by this method have considerably more penetrating ability than those produced by mechanical injectors. (auth)

1497

Radiation Lab., Univ. of Calif., Berkeley

KINETICS OF CYCLIC METABOLIC SYSTEMS AND THEIR APPLICATION IN THE STUDY OF THE MECHANISM OF PHOTOSYNTHESIS (thesis). Dan Fordham Bradley. Aug. 1953. 90p. Contract W-7405-eng-48. (UCRL-2326)

Conditions under the cyclic disulfide of 6,8-dithiooctanoic acid (6T) stimulates the rate of the Hill reaction in Scenedesmus cells with quinone as oxidant have been investigated. The conditions are specific with respect to plant species, the five-membered ring structure of 6T, temperature, incubation conditions, quinone concentration, algal density, 6T concentrations, and light intensity. A kinetic model of the proposed function of thioctic acid as the primary converter of electromagnetic to chemical bond energy has been set up, and the predictions of this model have been compared with the observed functional dependences of the over-all rate of oxygen evolution upon certain variables. The design of experiments to differentiate among the models proposed is suggested for future investigation. The kinetic models employed are suggested to be of convenient form for the study of metabolic pathways in vivo. (auth)

RADIATION EFFECTS

1498

Hanford Works

GROSS EFFECTS OF GROWTH INHIBITING LEVELS OF TRITIUM OXIDE ON CHLORELLA PYRENOIDOSA. J. W. Porter and M. S. Watson. Nov. 20, 1953. 18p. Contract W-31-109-Eng-52. (HW-30056)

Growth and cell division rates and average size of cells were determined for Chlorella growing in the presence and absence of tritium oxide, and plate assays were made to determine the number of viable cells. Assays of selected colonies were also made to determine whether irradiation of Chlorella produced genetically changed cells which differed in growth rate from that of unirradiated cells. Results are presented graphically and in tables. (auth)

1499

Naval Radiological Defense Lab.

STUDIES ON THE CHEMICAL NATURE OF THE RADIATION PROTECTION FACTOR IN MOUSE SPLEEN. 1. ENZYMATIC INACTIVATION BY DESOXYRIBONUCLEASE AND TRYPSIN. L. J. Cole and M. E. Ellis. Nov. 23, 1953. 32p. (USNRDL-418)

Crystalline enzymes have been employed as specific analytical tools for investigating the chemical nature of the factor in normal mouse spleen which affords protection against radiation mortality when administered to mice following otherwise lethal whole-body x-ray exposure in the LD_{100} range. Phosphate buffer homogenates of spleens from immature LAf_1 mice, as well as spleen nuclei, were incubated with crystalline desoxyribonuclease, ribonuclease, or trypsin at 25°C for 40 to 60 min. The enzyme-treated homogenates or nuclei were then assayed for radiation protection activity by administration to mature LAf_1 mice previously exposed to lethal x irradiation. The protective activity of these preparations was destroyed by the enzymatic action of desoxyribonuclease and by trypsin, but not by ribonuclease. The loss of protective activity of desoxyribonuclease treated nuclei suspensions was accompanied by the liberation of free desoxyribonucleic acid from a bound form in the nucleus. In the light of the known specificity of action of enzymes, and of the evidence in the literature that living cells are not acted upon by externally added enzymes, the present data support and are consistent with the conclusions that the spleen radiation protection factor is non-cellular in nature and that chemically it is a desoxyribonucleoprotein. (auth)

1500

OXIDATION AND REDUCTION EFFECTS IN IRRADIATED SUGAR. Peter Holtz. Translated from Naunyn-Schmiedeberg's Arch. Expti. Pathol. u. Pharmakol. 182, 141-59(1936). 16p. (AERE-Trans-11/3/5/389)

Irradiation of aqueous solutions of sugar and sugar-like substances with ultraviolet light results in the formation of reversibly oxidizable substances which form systems with strongly negative redox potentials. The absorption spectra of the irradiated solutions show absorption maxima which lie between 265 and 290 mμ. In the same region of wavelengths there lie the absorption maxima of ascorbic acid, Redukton, and sugar heated with alkali. It is probable that the changes produced by irradiation are the same as those produced by the action of high temperature on alkaline sugar solutions and are due to the formation of free, easily enolized CO groups. The irradiated sugars behave with certain biological systems in the same way as ascorbic acid. Thus they delay the autoxidation of cystein and protect adrenalin from oxidation and consequent loss of biological

effectiveness. They accelerate oxygen absorption by unsaturated fatty acids as does ascorbic acid. There is a detailed discussion of the importance of the photochemical production of reversibly oxidizable substances from sugar in the skin from the point of view of the biological effects of radiation. (auth)

1501

RELATIVE BIOLOGICAL EFFECTIVENESS OF FAST NEUTRONS, GAMMA RAYS, X-RAYS ON GRASSHOPPER NYMPH OVARIOLES. (MELANOPLUS DIFFERENTIALIS). Theodore N. Tahmisian and Howard H. Vogel, Jr. (Argonne National Lab., Lemont, Ill.). Proc. Soc. Exptl. Biol. Med. 84, 538-43(1953) Dec.

In order to destroy every egg in each grasshopper ovariole, with the exception of the most advanced, it was necessary to irradiate the total body with 350 r x rays, 420 r Co^{60} γ rays, or 22.5 rep of fast neutrons. Thus, the relative biological effectiveness of Co^{60} γ rays: 200 kv x rays: fast neutrons, for this specific effect, is 1.0: 1.2: 19. This is correlated with relative specific ionization and linear energy transfer. It is suggested that damage to the grasshopper ovariole could be used as a biological dosimeter for fast neutron doses in the range 10 to 50 rep. (auth)

1502

EVALUATING THE SAFETY OF RADIATION-STERILIZED FOODS. A. J. Lehman and E. P. Laug (Dept. of Health, Education, and Welfare, Washington). Nucleonics 12, No. 1, 52-4(1954) Jan.

Factors to be considered in evaluating the safety of radiation-sterilized foods are discussed. It is pointed out that before embarking on extensive and expensive animal experimentation, the minimum dosage of β and γ radiation necessary to effect commercially satisfactory sterilization and the minimum dosage of radiation that can produce clear and well-defined deterioration of the product with respect to toxicity and wholesomeness, should be determined. Acceptability of the minimum dosage of radiation for processed food should be determined on the basis of texture, taste, smell, and keeping qualities. Methods that are in current use for testing the safety and wholesomeness of foods are reviewed critically from the standpoint of their applicability to the testing of radiosterilized food. (C.H.)

1503

EFFECT OF X-IRRADIATION ON TISSUE HYDRATION IN THE MOUSE. Roberts Rugh (Columbia Univ., New York). Nucleonics 12, No. 1, 28-33(1954) Jan.

Data are presented on changes in wet and dry weight and percentage of water in ten separate organs and the remaining carcass of mice three days after exposure to a lethal dose of x radiation. Contrary to expectation, percentage changes of total body water were secondary to decrease in the aggregate dry weight of 5 to 18%. Although adult nerve tissues have been considered radioresistant, the dry weight of the brain was found to increase by 7.7 to 14.3%. (C.H.)

RADIATION HAZARDS AND PROTECTION

*1504

Atomic Energy Project, Univ. of Rochester

ATMOSPHERIC MONITORING FOR ALPHA EMITTERS USING MOLECULAR FILTER MEMBRANES. Thomas T. Mercer. Jan. 4, 1954. 24p. Contract W-7401-eng-49. (UR-294)

The absorption of α particles by molecular filter membranes used to sample an atmosphere of UO_2 was found to be negligible for purposes of air monitoring. The ratio of weight of UO_2 as determined by counting the α activity on the filter to weight of UO_2 as determined chemically was 0.97 ± 0.06 at a linear sampling velocity of 45 ft/min and 0.91 ± 0.05 at a velocity of 90 ft/min. A general equation was derived for the activity on filter paper of any isotope in a decay series present in the atmosphere being sampled. Using this equation, decay curves were calculated for the case in which the atmosphere being sampled contained average concentrations of RaA and Th B. These were compared with decay curves for the case where the atmosphere contained these same concentrations of RaA and ThB plus the maximum permissible concentration of Pu. Background values of natural airborne α activity were determined over a period of nine months in a laboratory designed for experiments involving α emitters. Average values for RaA and ThB were found to be 1.3×10^{-13} c/l and 5.2×10^{-15} c/l, respectively. (auth)

1505

STUDIES WITH CYSTEINAMINE AND CYSTEINE IN X-IRRADIATED ANIMALS. Robert L. Straube and Harvey M. Patt (Argonne National Lab., Lemont, Ill.) Proc. Soc. Exptl. Biol. Med. 84, 702-4(1953) Dec.

The observation of a post-irradiation effect of cysteinamine in rats with the liver area shielded has not been verified. Cysteinamine is about 5 times as effective as cysteine when given to mice intravenously in equimolar amounts prior to x irradiation. However, maximally tolerated doses of each give equivalent protection. Cysteinamine and cysteine appear to be additive in their protective effect against acute radiation lethality. This is suggestive of a similar mechanism of action. (auth)

RADIOGRAPHY

1506

SIMPLIFIED AUTORADIOGRAPHY EXPOSURE CALCULATION. William W. Wainwright, Ernest C. Anderson, Preston C. Hammer, and Charles A. Lehman. (Los Alamos Scientific Lab., N. Mex.). Nucleonics 12, No. 1, 19-21(1954) Jan.

A chart is presented for calculating the minimum exposure time of radioautograms for which a β emitter is used as the radiation source. A specimen of approximately 1 cm^2 is assumed. The relative usefulness of radioisotopes when several are available for an experiment is discussed, and a chart is included which shows comparative half lives and relative spread in emulsions from a point source. The advantage of using a radioisotope with a weak emission and a long life for autoradiographic purposes is stressed. An apparatus is described and illustrated photographically which provides a rapid uniform technique for measuring the β activity of specimens for radioautographic purposes. (C.H.)

TOXICOLOGY STUDIES

*1507

Atomic Energy Project, Univ. of Rochester

POLONIUM IN THE URINE OF MINERS EXPOSED TO RADON. Mary Sultzer and J. B. Hursh. Dec. 7, 1953. 28p. Contract W-7401-eng-49. (UR-266)

The urine of 19 miners working in the U mines of the Colorado Plateau and chronically exposed to high Rn concentration has been found to contain amounts of Po^{210} varying from 2 to 38 $\mu\mu$c per liter, whereas no Po could be found in the urine of unexposed laboratory personnel. It is proposed that urinary Po measurements may serve as a rough measure of cumulative lung exposure to Rn and its daughters since the daughters decay to Pb^{210}, a Pb isotope with a long effective half life in the body and a decay scheme producing Po^{210}. Calculations are presented to show that Po levels in the range of the experimental values obtained on miners' urine might be expected on general grounds and that a part of the body Pb^{210} content comes from the Rn accumulation in body fat. (auth)

1508
EFFECT OF 2,3-DIMERCAPTOPROPANOL (BAL) UPON DISTRIBUTION AND EXCRETION OF PLUTONIUM. Bergene Kawin and D. Harold Copp (Univ. of Calif., Berkeley). Proc. Soc. Exptl. Biol. Med. 84, 576-7(1953) Dec.

Intramuscular injection of 2,3-dimercaptopropanol (BAL) in doses therapeutically effective in As and Hg poisoning had no effect on the distribution and excretion of injected Pu whether given prior to or following the administration of the metal. (auth)

TRACER APPLICATIONS

1509
Atomic Energy Project, Univ. of Calif., Los Angeles
THE UPTAKE OF RADIOACTIVE FISSION PRODUCTS BY RADISHES AND LADINO CLOVER FROM SOIL CONTAMINATED BY ACTUAL SUB-SURFACE DETONATION FALL-OUT MATERIALS. Kermit H. Larson, Jon H. Olafson, James W. Neel, and Allen J. Steen. Issued Dec. 14, 1953. 35p. Contract AT-04-1-GEN-12. (UCLA-272)

Certain radioactive products, predominantly Sr^{89}, originating from an underground detonation were found to be available to radishes and ladino clover. The studies reported are based on data obtained for the period 8 to 570 days after the underground detonation. The total amount of activity accumulated by the crop plants is not proportional to the radioactive contamination remaining in and on the soil. The maximum activity accumulated by the radish plant was 175 dis/sec/g dry plant material grown in fall-out contaminated soil assaying 480 dis/sec/g at the time the crop was planted (109 days after detonation). The availability of certain fission products from fall-out material from an underground detonation appears to be a function of solubility. The radioactivity in the plants was due to Sr^{89} primarily, based on decay and energy characteristics, which show a half life of approximately 55 days and a β energy of 1.5 Mev, and consideration of the known availability of Sr isotopes to plants growing in contaminated soils. Yttrium^{91}, which has essentially the same decay and energy characteristics, is ruled out on the basis of other studies with this isotope as a soil contaminant. The selective uptake of Sr^{89}, a medium half-life isotope, largely explains the decrease in observed plant radioactivity between successive crops. (auth)

WASTE DISPOSAL

1510
SURVEY OF RADIOACTIVE-WASTE DISPOSAL PRACTICES. H. S. Miller, F. Fahnoe, and W. R. Peterson (Vitro Corp. of America, New York). Nucleonics 12, No. 1, 68(1954) Jan.

A summary of answers to a questionnaire sent to 1,027 users of radioisotopes concerning waste disposal practices, problems, and costs is presented in tabular form. (C.H.)

CHEMISTRY

*1511
Los Alamos Scientific Lab.
CATALYSIS BY Pt(III) OF EXCHANGE REACTIONS OF $PtCl_4^{=}$ AND $PtCl_6^{=}$. Ronald L. Rich and Henry Taube. [1953] 12p. (AECU-2787)

One path for the exchange of $PtCl_6^{-2}$ and Cl^- involves a chain mechanism. The reaction by this path is initiated by light, catalyzed by $PtCl_4^{-2}$, inhibited by $Fe(CN)_6^{-3}$, $IrCl_6^{-2}$, Cl_2, and some reducing agents. The rate of exchange by non-chain paths is very slow, the exchange reaction in the presence of inhibitors having a half life in excess of a week at 25° and at concentration level of ~0.01M. The exchange of $PtCl_4^{-2}$ and Cl^- is induced by Ce(IV) but not by Cl_2. The exchange of Pt between $PtCl_4^{-2}$ and $PtCl_6^{-2}$ is catalyzed by light, and inhibited by $IrCl_6^{-2}$. These phenomena are explained by a common intermediate, a chloro complex of Pt(III). It is generated by the action of light on $PtCl_6^{-2}$ by $1e^-$ oxidizing agents on $PtCl_4^{-2}$, it can exchange associated Cl^- rapidly with Cl^- in solution, and can exchange oxidation state rapidly with $PtCl_4^{-2}$ and $PtCl_6^{-2}$. (auth)

1512
Illinois Inst. of Tech.
A STUDY OF PROPERTIES OF NONELECTROLYTIC SOLUTIONS. FINAL REPORT. Scott E. Wood. October 1953. 9p. Contract AT(11-1)-90. (AECU-2788)

A study was made of the various properties of nonelectrolytic solutions and the correlation of the properties with intermolecular forces existing between the molecules of the components. The solubility of I in CCl_4-C_6H_6-systems is tabulated. The volume of mixing of benzene-isoöctane systems is reported. (J.E.D.)

1513
Los Alamos Scientific Lab.
PHYSICO-CHEMICAL STUDIES OF THE SIMPLER POLYPEPTIDES. 3. THE ACID AND BASE CATALYZED HYDROLYSIS OF DI-, TRI-, TETRA-, PENTA-, AND HEXA-GLYCINE. Edward F. Hammel, Jr., Frick Chemical Lab., Princeton Univ. and Samuel Glasstone, Los Alamos Scientific Lab. [1951?] 19p. (AECU-2791)

The specific rates for the acid (2N HCl at 65 and 75°) and base (2N NAOH at 20 and 30°) hydrolysis of di-, tri-, tetra-, penta-, and hexaglycine have been determined. It is shown that for tetra- and higher polyglycines these rates increase approximately linearly with the number of glycine residues in the chain. The specific rate for the fission of the central peptide bond in tetraglycine has been derived from the data. Heats and entropies of activation for the acid- and base-catalyzed hydrolysis of diglycine are reported. (auth)

1514
Callery Chemical Co.
MELTING POINT DIAGRAMS OF ALKALI HALIDE AND OF ALKALI BOROHYDRIDE SYSTEMS. G. F. Huff and R. H. Shakely. Jan. 13, 1954. 25p. (CCC-1024-TR-2)

The liquidus curves and surfaces of a number of fused-salt systems are presented in graphical form. The data used to construct these diagrams were obtained in part from the literature and in part from cooling-curve measurements. The systems represented are various combinations of alkali halides and of alkali borohydrides. (auth)

*1515
Ames Lab.
CAUSTIC TREATMENT OF ZIRCON SAND. G. H. Beyer, D. R. Spink, J. B. West, and H. A. Wilhelm. [Dec. 28, 1953]. 15p. Contract W-7405-eng-82. (ISC-437)

The most abundant domestic Zr ore is zircon (Zr silicate). Caustic soda was found to be effective in decomposing this ore. Using a caustic-to-zircon weight ratio of 1.1:1 and a furnace temperature of 1050°F, it was found that 80 to 90% of the zircon reacted to form water-soluble Na silicates and water-insoluble Na zirconates. The zirconates were readily converted, after leaching with water, to high-purity Zr compounds such as the oxychloride, fluoride, sulfate, hydroxide, oxide, and nitrate. The low caustic-to-zircon ratio and the simple equipment for decomposing the sand without previous grinding make this process convenient and economically attractive. (auth)

1516
Livermore Research Lab., Calif. Research and Development Co.
STATIC CORROSION OF URANIUM, ZIRCONIUM AND COPPER BY "AROCHLOR". P. O. Strom. Issued Dec. 1953. 7p. Contract AT(11-1)-74. (LRL-63)

Static corrosion tests have been carried out on U, Zr, and Cu in "Arochlor" media under various atmospheres and at various temperatures. Uranium was tested at 60, 100, and 200°C under air atmosphere and at 200 and 310°C under A and He atmospheres. Zirconium was tested at 60, 100, and 285°C and Cu at 60 and 100°C, all under air atmosphere. Uranium exhibits a relatively low corrosion rate at 60 and 100°C and a relatively high rate at 200 and 310°C, while Zr and Cu exhibit good resistance in the range of conditions of exposure. The corrosion rate of U in "Arochlor" was decreased by the presence of an inert atmosphere. (auth)

*1517
Columbia Univ.
VAPOR PRESSURE OF SODIUM. PROGRESS REPORT. M. M. Makansi, C. H. Muendel, and W. A. Selke. Dec. 1, 1953. 6p. Contract AT(30-1)-1101. (NYO-3101)

Experimental data on the vapor pressure of Na in the range of one to five atm. pressure have been obtained. The results are closely fitted by the equation of Rodebush and Walters, log P = 7.5510 – 5400/T, where P is in millimeters of Hg and T is in degrees Kelvin. The experimental range is being extended. (For preceding period see NYO-3100.) (auth)

*1518
Pittsburgh Univ.
THE INFLUENCE OF STRUCTURE ON THE STABILITY OF CHELATES OF SOME SUBSTITUTED 8-HYDROXYQUINOLINES AND ANALOGOUS REAGENTS (thesis). William Dwight Johnston. 1953. 165p. (NYO-6346)

The Calvin-Bjerrum titration technique for the determination of chelate formation constants has been applied to metal chelates of 8-hydroxyquinoline, 2-methyl-8-hydroxyquinoline, 4-methyl-8-hydroxyquinoline, 2-phenyl-8-hydroxyquinoline, 3-hydroxythieno(3,2-b)pyridine, 1,2,3,4-tetrahydro-8-hydroxyquinoline, 2-(o-hydroxyphenyl)-pyridine, 1-(o-hydroxyphenyl)-isoquinoline, 2-(o-hydroxyphenyl)-benzimidazole, and 2-(o-hydroxyphenyl)-imidazoline. The heats and entropies of chelation were calculated for chelates of 2-methyl-8-hydroxyquinoline and 4-methyl-8-hydroxyquinoline. The data obtained were interpreted in terms of steric hindrance, reagent basicity, and structural parameters of the metal ions. The analytical behavior of several of these reagents with metal ions has been studied. The infrared spectra of certain chelates of 2-methyl-8-hydroxyquinoline and 4-methyl-8-hydroxyquinoline have been obtained. Attempts were made to interpret these spectra in terms of chelate stability. (auth)

1519
Technical Information Service, AEC
A BIBLIOGRAPHY OF SELECTED AEC REPORTS OF INTEREST TO INDUSTRY. PART 2. CHEMISTRY AND CHEMICAL ENGINEERING. Dec. 1953. 54p. (TID-3050(pt.2))

This bibliography consists of 290 selected references to non-secret reports on developments in the fields of chemistry and chemical engineering. The compilation is primarily for persons in industry who have limited familiarity with AEC-developed technology or the literature reporting it. A subject index provides a detailed guide to the specific material covered by each document listed in this bibliography, and the availability of each document is indicated at the end of each abstract. (C.H.)

1520
INVESTIGATION OF THE CALCIUM AND HYDROGEN SYSTEM. III. A THEORETICAL CONSIDERATION OF THE MECHANISM INVOLVED IN THE GROWTH OF NUCLEI CONSISTING OF CALCIUM HYDRIDE OR DEUTERIDE. Izumi Higuchi and Yoshio Kawana. Translated from J. Chem. Soc. Japan, Pure Chem. Sect. 71, 624-7(1950). 6p. Available from Associated Technical Services (Trans. No. 46EJ2), East Orange, N. J. (AEC-tr-1765)

The mechanism of growth of the CaH_2 or CaD_2 nuclei formed on Ca metal was discussed in the light of Eyring's absolute reaction rate theory for heterogeneous reactions. (auth)

1521
ISOTOPIC EXCHANGE OF OXYGEN IN SOLUTIONS OF PHOSPHORUS ACIDS. A. I. Brodskii and L. V. Sulima. Doklady Akad. Nauk. S.S.S.R. 92, 589-92(1953) Sept. 21. (In Russian)

The kinetics of the exchange can be expressed by the expression $-\ln(1-z) = K(c_0 + c_1)t$ where $z = y/y_\infty$ and c_0 and c_1 are the concentrations of the water and the dissolved material. The $-\ln(1-z)$ for NaH_2PO_2, NaH_2PO_2 + KOH, $NaH_2PO_2 + CH_3CO_2H$, H_3PO_3, and H_3PO_4 was plotted against time. The isotopic exchange proceeds in the order $PO_2^{-3} \gg PO_3^{-3} > PO_4^{-3}$. An exchange mechanism is proposed. (J.S.R.)

1522
ON THE HYDROXIDE OF COLLOIDAL THORIUM. I. ON THE FORM AND DIMENSION OF COLLOIDAL PARTICLES. A. Dobry, S. Guinand (Institut de Biologie physico-chimique, Paris, France), and A. Mathieu-Sicaud (Sorbonne, Paris, France). J. chim. phys. 50, 501-6(1953) Oct. (In French)

Four methods have been employed for the study of the colloidal particles of $Th(OH)_4$ in solution at various degrees of dialysis: the electron microscope, birefringence of movement, the diffusion of light, and viscosity. The electron microscope reveals that, in a very dilute solution, the particles are filiform with least statistic length 700 A and apparent width 18 A. The filaments are somewhat branched and rolled into balls. It is the first example of inorganic filiform macromolecules formed by ionic reaction. The birefringence of movement indicates also the presence in a dilute solution of asymmetric particles in which the longitudinal axis is of the same length as that found by the electron microscope. On the contrary, the diffusion of light and the viscosity show that the particles are, in solutions 0.2 to 2.0% by weight, compact balls. They inflate on dilution. One can reconcile the data from the different methods used by admitting a progressive inflation and unwinding of the balls on dilution. (tr-auth)

1523
ON THE ELECTROVISCOUS EFFECT. III. SOLUTIONS OF THORIUM HYDROXIDE. A. Dobry (Institut de Biologie physico-chimique, Paris, France). J. chim. phys. 50, 507-11(1953) Oct. (In French) (cf. J. chim. phys. 47, 402(1950))

Three different mechanisms are known by which electric charges can influence the viscosity of a suspension or colloidal solution. Each of these causes an electroviscous effect. Experimentally, one can only measure a total effect. In the case of colloidal solutions of $Th(OH)_4$, it appears that all three mechanisms act simultaneously, giving a high value for the total effect. An attempt was made to separate each of the effects by using supplementary data obtained by the diffusion of light. The study of the viscosity alone is insufficient. (tr-auth)

ANALYTICAL PROCEDURES

1524

Atomic Energy Research Establishment, Harwell, Berks (England)

THE DETERMINATION OF DYSPROSIUM IN HOLMIUM OXIDE BY RADIOACTIVATION ANALYSIS. G. Phillips and F. W. Cornish. Nov. 10, 1953. 10p. (AERE-C/R-1276)

The Dy content of 'Specpure' Ho_2O_3 has been determined by radioactivation analysis without chemical separation. The composite decay curve for the sample after neutron irradiation has been resolved by calculation from the experimental points. Dilution of the sample by grinding with sucrose in the solid state has been shown to lead to an inhomogeneous mix compared with aqueous dilution. Two series of experiments have been carried out using aqueous dilutions; liquid counting gave 11.71 ± 0.09% Dy in Ho_2O_3, while solid counting gave 11.66 ± 0.16% Dy in Ho_2O_3. The error limits refer to standard deviation of the mean. (auth)

1525

Atomic Energy Research Establishment, Harwell, Berks (England)

THE RADIOMETRIC ASSAY OF URANIUM AND THORIUM ORES. E. Franklin and R. K. Barnes. 1953. 59p. (AERE-EL/R-1175)

Work on various methods of assay of U and Th in ores by purely radiometric methods is described. Some of the methods are applicable only to ores containing either U or Th separately, and some can be used when a mixture of the two is present in one ore. Methods of dealing with ores in which the radioactive constituents are not present in their equilibrium preportions are discussed. (auth)

*1526

Argonne National Lab.

A MODIFIED RADIOCHEMICAL STRONTIUM PROCEDURE. Elton Turk. Dec. 1953. 8p. Contract W-31-109-eng-38. (ANL-5184)

A modified procedure for radiochemical Sr analysis has been developed. Data are presented to show that comparable results and radiochemical purity are obtained for Sr samples prepared by the modified procedure compared to samples prepared by the conventional fuming HNO_3 procedure. The modified procedure consists of adding Sr carrier to the sample, removing three $Fe(OH)_3$ scavenging precipitates, and isolating the Sr as $SrCO_3$. (auth)

*1527

Oak Ridge National Lab.

DETERMINATION OF THE ALKALI METALS BY NEUTRON ACTIVATION ANALYSIS. G. W. Leddicotte and S. A. Reynolds. Issued Oct. 21, 1953. Decl. Jan. 7, 1954. 17p. Contract W-7405-eng-26. (ORNL-1623)

The nuclear reactions which take place in the ORNL graphite reactor now form the basis of an analytical service for the determination of trace elements in many different materials. The techniques of the method, its sensitivities, and applications are discussed. Special attention is directed to the determination of trace amounts of the alkali metals by neutron activation analysis. (auth)

1528

ON SOME NEW METHODS OF CHEMICAL ANALYSIS WITH THE AID OF PYRIDINE, ALPHA-PICOLINE, AND HEXAMETHYLENETETRAMINE. E. A. Ostroumov. Translated by Leon Marshak from Zavodskaya Lab. 13, 404-10(1947). 13p. (AEC-tr-1755)

The precipitation of Fe, Al, Cr, Ti, In, Ga, Zr, and several rare metals and their separation from Mn, Ni, Co, Zn, Cu, Cd, alkaline earths, Mg, and alkali metals are described. The precipitation is carried out by heating a weakly acid solution with pyridine in the presence of NH_4Cl. Beryllium can be separated from the other elements in group II by precipitating $Be(OH)_2$ with α-picoline. Mn, Ni, Co, Zn, Fe, Al, Cr, Ti, and Zr can be precipitated with hexamethylenetetramine and separated from the alkaline earths, Mg, and alkali metals. (J.S.R.)

1529

EXPERIMENTS ON THE USE OF SOLUTION SPECTRUM ANALYSIS FOR THE DETERMINATION OF MANGANESE AND MAGNESIUM IN ALUMINIUM ALLOYS. (Erfahrungen mit der Losungsspektralanalyse zur Bestimmung von Mangan und Magnesium in Aluminium-Legierungen). R. Bauer. Translated by R. C. Murray from Aluminium 22, 9-12(1940). 8p. (RAE-Trans-389; ATI-120545)

The use of a solution of the sample in HNO_3 soaked into C sparking electrodes, instead of electrodes of the alloy itself, has been shown to give more reliable results in the determination of Mn, Mg, Fe, and Cu in all alloys. In most cases the results fell within a tolerance of ±5%. (auth)

1530

THE DETERMINATION OF SMALL AMOUNTS OF POTASSIUM, CALCIUM AND MAGNESIUM IN SODIUM AND ITS COMPOUNDS. Louis Silverman and K. Trego (North American Aviation, Inc., Downey, Calif.) Analyst 78, 717-21(1953) Dec.

Preliminary concentration is necessary before K can be determined in the presence of large amounts of Na ion. Metallic Na, NaOH and Na salts are converted to the chloride. Measured, cold, saturated aqueous chloride solutions are treated with dry HCl gas, which separates the bulk of the NaCl. The residual K, Ca, and Mg can then be determined by the usual methods. Calcium and Mg may also be determined with or without preliminary NaCl separation. (auth)

DEUTERIUM AND DEUTERIUM COMPOUNDS

1531

SPECTROGRAPHIC ESTIMATION OF DEUTERIUM. (Dosage Spectrographique du Deuterium). A. Van Tiggelen. Translated by B. E. C. Jenkins from Bull. soc. chim. Belges 55, 133-59(1946). 24p. (RAE-Trans-425; AD-12611)

Mixtures of H_2 and D_2, containing 15 to 85% D_2, have been spectrographically analyzed with an average variation of ±2% of the minor constituent. The gas mixture, at a pressure of 1.5 mm Hg in a Geissler tube with external electrodes, was subjected to a h-f Tesla discharge. The composition of the mixtures was determined by measuring the relative intensities of H_β and D_β lines on the photographic plate, using the stepped sector method. The experimental curve was found to be a straight line represented by the equation:

$$\text{Efficiency difference } \Delta\epsilon = 0.05 + \log \frac{H\%}{D\%}$$

It was found essential to degas the discharge tube by heating to 350°C under a high vacuum for several hours. Mercury vapor was eliminated by condensing the gas mixture at a temperature of about −80°C before filling the discharge tube. Mixtures of D_2 with either H_2S or NH_3 were analyzed for the D_2 content by the same method. The analytical curves were found to vary slightly when other elements, in this case S or N, were present in the tube. The reproducibility was poorest with the mixtures containing NH_3. The equation representing the experimental curve can be interpreted to some extent by assuming a preferential excitation of light H_2 due to the difference in energy at the lowest energy level between H bonds and D bonds. (auth)

GRAPHITE

1532

Alfred Univ.

GRAPHITIZATION OF CARBON. TECHNICAL PROGRESS REPORT. V. D. Frechette and Yung Tao. Dec. 31, 1953. 10p. Contract AT(30-1)-1297. (NYO-3764)

Investigation of the improvement of the structure of graphite blocks with special attention to their bulk density continued with a study of surface oxidation to graphitic acid and its effect on compaction. Graphs showing the differential thermal analysis and bulk density at various pressures are given. (For preceding period see NYO-3763.) (J.A.G.)

MOLECULAR STRUCTURE

1533

Ames Lab.

A THEORETICAL STUDY OF THE ELECTRONIC STRUCTURE OF WATER. Frank O. Ellison and Harrison Shull. July 1953. [TIS issuance date Jan. 1954]. 119p. Contract W-7405-eng-82. (ISC-418)

A brief general description is presented of the two approximations, the molecular orbital (MO) and the valence bond (VB) methods, which are generally utilized in treating problems of electronic structure. The historical application of these methods to the water molecule is then reviewed and discussed in some detail. The more recent qualifications of these early treatments are described and found to yield quite satisfactory qualitative explanations for the electronic properties of H_2O. The general formulation of the present SCF LCAO MO treatment of H_2O, the evaluation and approximation of integrals involved in the calculations, and the results and interpretations thereof are presented. A brief list of the major conclusions derived from this work is included. (auth)

RADIATION CHEMISTRY

1534

FREE RADICAL-INITIATED $O^{16}O^{18}$-H_2O^{16} EXCHANGE REACTION IN AQUEOUS SOLUTION. Edwin J. Hart, Sheffield Gordon, and Dwight A. Hutchison (Argonne National Lab., Lemont, Ill.). J. Am. Chem. Soc. 75, 6165-9(1953) Dec. 20. (cf. NSA 6-6565)

A γ-ray-initiated chain exchange reaction of isotopically enriched dissolved O with normal O of the water has been found in alkaline solutions. The yield of this reaction is independent of dosage rate of γ rays or intensity of ultraviolet light, increases with pH and concentration of enriched dissolved oxygen, and decreases with increasing concentration of H_2O_2. The kinetic study provides evidence for the existence of the equilibrium: $OH = H^+ + O^-$. The propagation steps are concluded to be: $O^- + O_2^* = O^{*-} + O_2$ and $O^{*-} + OH^- = O^- + O^*H^-$, and the termination steps postulated as: $O^- + H_2O_2 = OH^- + HO_2$ and $O^{*-} + H_2O_2 = O^*H^- + HO_2$. ($O^*$ is used to designate O_2 of 1.4 at. % O^{18}. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

*1535

Ames Lab.

THE USE OF COPPER AS THE RETAINING ION IN THE ELUTION OF RARE EARTHS WITH AMMONIUM ETHYLENEDIAMINE TETRAACETATE SOLUTIONS. F. H. Spedding, J. E. Powell, and E. J. Wheelwright. Dec. 8, 1953. 13p. Contract W-7405-eng-82. (ISC-433)

A rapid method for separating mixtures of rare earths into the pure components is described. The method consists of eluting a band of mixed rare earths adsorbed on a cation-exchange resin through a second cation-exchange bed in the Cu(II) state. The eluant consists of an NH_3-buffered solution of (ethylenediamine)tetraacetic acid. It was found that gram quantities of pure heavy rare earths could be obtained in a few days by this method. (auth)

1536

University of Southern Calif.

STUDIES OF THE RARE EARTH HYDRIDES. PROGRESS REPORT [FOR] PERIOD OCTOBER 1, 1952–NOVEMBER 15, 1953. James C. Warf and William L. Korst. Nov. 15, 1953. 29p. Contract Nonr-228(03), Technical Report No. 2. (NP-5006)

The surface of coarse Ce hydride was found to be wetted by Hg, forming a heterogeneous mass. The pulverized hydride was "amalgamated" to form a uniform dispersion, with a strong tendency to adhere to glass. Lanthanum hydride behaved similarly. Cerium hydride dispersions decomposed into H and Ce amalgams above approximately 115°, and reacted vigorously with water at room temperature. On exposure to air, dilute dispersions oxidized to CeO_2, while the more concentrated preparations oxidized in part and precipitated the unchanged hydride in part. Freezing and cooling curves of U hydride and Ce hydride dispersions showed no depression of the freezing point of the Hg. Filtration of Ce hydride dispersions through sintered glass removed nearly all of the dispersed phase and gave a filtrate 0.008% in Ce hydride. An indication of the maximum particle size of the Ce hydride in the filtrate is obtained from the 5-μ maximum pore size of the sintered glass filter. A brief status report on the dissociation pressure studies is presented. A high-temperature furnace thermostatted at 750 to 1000° for use in this work is described. A silica torsion balance to be used in measuring compositions of solid phases in these investigations is reported. Finally, the status of x-ray-diffraction work with the rare earth hydrides is given. (auth)

SEPARATION PROCEDURES

*1537

Stanford Research Inst.

CONTINUOUS COUNTERCURRENT ION EXCHANGE WITH TRACE COMPONENTS. TECHNICAL REPORT NO. 5. Nevin K. Hiester, Earl F. Fields, Russell C. Phillips, and Shirley B. Radding. June 24, 1953. 56p. Contract AT (11-1)-110, Report No. 30. (AECU-2737)

A design theory was developed for countercurrent ion exchange, under trace conditions based on kinetic and equilibrium considerations. Equipment was designed to provide continuous countercurrent contact between a moving bed of ion exchange resin and the solutions to be treated. This equipment was evaluated experimentally by the separation of trace ionic components in a feed solution. Contract efficiency was improved with a vibrated screen assembly which was immersed in the moving bed and which produced continual reorientation of the resin particles. The data were correlated in an equation which related the height of a transfer unit with operating variables and the characteristics of the resin-ion system. The results are given in graphical and tabular form. (auth)

*1538

Stanford Research Inst.

COUNTERCURRENT ION EXCHANGE WITH GROSS COMPONENTS. PART 1. IN AN EQUILIBRIUM STAGE CONTACTOR. PART 2. IN A CONTINUOUS COUNTERCURRENT COLUMN. TECHNICAL REPORT NO. 6. Nevin K. Hiester, Russell C. Phillips, and Raymond K. Cohen. June 25, 1953. 68p. Contract AT(11-1)-110, Report No. 31. (AECU-2738)

Ion exchange separations under gross conditions, i.e., where nonlinear equilibrium isotherms govern, are

discussed. The variables affecting the separation of two or more ionic components in such a multicomponent system were considered in the development of a semigraphical design procedure. This method permits the design of equilibrium stage units involving countercurrent contact between resin and solution, making it possible to predict the behavior of the contactor from the operational variables and the equilibrium relations for the system. The design procedure, involving step-by-step calculations, was suggested by the Lewis and Cope method for multicomponent distillation. The method was applied to the evaluation of experimental data which were obtained under gross conditions with a countercurrent mixer-settler contactor. Comparisons of the ion separations obtained with this apparatus on a Li^+-K^+-H^+-Chempro C-20 resin system and the values predicted by the design procedure showed good agreement. The design method for the exchange of gross components was extended to apply to a continuous countercurrent column. In this procedure, the number of theoretical equilibrium contacts required for a specific exchange of any two gross components, in a multicomponent system, is determined graphically as before. These calculated results were then used to obtain a theoretical bed height from a modified mass-transfer correlation which relates the height equivalent to an equilibrium contact with the characteristics of the ion-resin system and the operating variables in the continuous column. Several runs made with a moving bed of resin were evaluated by this technique. Fair agreement between the theoretical and observed bed heights was obtained. (auth)

*1539

Stanford Research Inst.

ANALYTICAL METHODS USED IN THE STUDIES ON CONTINUOUS SEPARATION OF IONS BY COUNTERCURRENT ION EXCHANGE. TECHNICAL REPORT NO. 4. Nevin K. Hiester, Russell C. Phillips, Shirley B. Radding, and Oliver D. Smith. Apr. 10, 1953. 30p. Contract AT(11-1)-110, Report No. 27. (AECU-2741)

Flame photometric methods were used for the determination of H^+, K^+, and Li^+ in an ion-exchange system. The removal of Li^+ and K^+ from the resin was attempted by elution with an excess of H^+ and by destruction of the resin by thermal or wet chemical oxidation. The former method gave the best results. The total exchange capacity of the resin was determined by two methods. In one, the H resin was incrementally titrated with OH^- to the pH breakpoint. In the other, an aliquot of resin, in the H form, was completely converted to a metal ion form such as Na^+ or Ca^{++} by contact with a large excess of the metal salt solution, and the displaced H^+ was titrated. The Ca^{++} elution method was chosen because of its ease, rapidity, and reproducibility of results. The final analytical methods adopted are given in detail in the appendix. (For the preceding report in this series see AECU-2751.) (J.S.R.)

*1540

Stanford Research Inst.

COUNTERCURRENT ION EXCHANGE. FINAL SUMMARY REPORT. Nevin K. Hiester and Russell C. Phillips. June 30, 1953. 9p. Contract AT-(11-1)-110, Report No. 34. (AECU-2742)

The accomplishments of research on countercurrent ion exchange are briefly summarized, including theory and equipment developments (trace ion exchange, equilibrium stage contactor, continuous column, gross ion exchange) and an economic evaluation of ion exchange processes (separation of trace ions, ion removal). (J.A.G.)

*1541

Illinois Univ. Engineering Experiment Station

REMOVAL OF NITROGEN OXIDES FROM GASEOUS MIXTURES. TECHNICAL REPORT NO. 10. M. S. Peters, C. P. Ross, and L. B. Andersen. Sept. 30, 1953. 107p. Contract AT(30-3)-28. (COO-1011)

Nitrogen dioxide and N_2O_4 may be removed from gaseous mixtures by contact with water. The mechanism of the removal process was studied using a bubble-cap plate column and a venturi atomizer. The rates of the chemical reactions involved in the removal process were found to be the controlling factor in the over-all mechanism. The major chemical reactions occur between N_2O_4 and NO_2, respectively, and water vapor in the gas film. The removal efficiency was greatest at high concentrations of N oxides (NO_2 and N_2O_4) which correspond to high fractions of N_2O_4 in the equilibrium mixture of NO_2 and N_2O_4. The absorption rates obtained with the venturi atomizer were much higher than with conventional absorption equipment owing to the large liquid surface available with a venturi atomizer. Tests with steam added to the entering gases indicated that an increase in humidity increases the rate of removal of N oxides from gaseous mixtures. (auth)

*1542

Pittsburgh Univ.

ACETYLACETONE AS AN ANALYTICAL EXTRACTION AGENT (thesis). John Franklin Steinbach. 1953. 127p. (NYO-6347)

Chromium (III), Co (III), Fe (III), Be, Cu, Al, Ga, In, V, Zr, and Zn were found to be extracted by acetylacetone to an extent dependent on the pH of the aqueous phase. Within this group it was found possible to separate Cu quantitatively from Zn by adjusting the pH to 2. Also Fe impurities can be removed from Al and In salts by extraction with acetylacetone. From the $pH_{1/2}$ values and solubility characteristics of metal acetylacetonates listed, many other separations can be envisioned. It would be possible to separate Ni and Co by oxidation and extraction of the Co (III) acetylacetonate. It would be possible to separate Be and Al and the members of the group Al, Fe, and Cr. In general, metals whose $pH_{1/2}$ values are separated by about two pH units can be quantitatively separated. In addition, separation of some acetylacetonates such as Fe and Hg, Ni and Cu, and Be and Mg could be effected without pH regulation since one member of each pair is insoluble in acetylacetone. The effectiveness of acetylacetonate separations can be increased, as is the case with solvent extraction generally, by the use of multiple-step processes such as countercurrent distribution. Acetylacetone should be especially well suited to countercurrent distribution experiments because the concentration of the reagent would not change, and therefore the $pH_{1/2}$ values will remain constant during the process. (Some of the material in this report appears in NYO-3070 and in NYO-3770.) (auth)

SORPTION PHENOMENA

1543

THE RATE OF ABSORPTION OF HYDROGEN BY METALLIC CALCIUM. Yoshio Kawana. Translated from J. Chem. Soc. Japan, Pure Chem. Sect. 71, 494-6(1950). 6p. Available from Associated Technical Services (Trans. No. 45E2J), East Orange, N. J. (AEC-tr-1766)

It was found that the absorption of H by a block of Ca does not take place until a nucleus of the β phase is formed. The rate of growth of the nuclei is proportional to the interfacial (boundary) area between the nucleus and Ca. The rate of growth of the nuclei is expressed by the equation:

$$\frac{dV}{dt} = KV^{2/3} = K_a \cdot S$$

It was also demonstrated that the rate is proportional to the pressure of H at 300°C. The activation energy of the reac-

tion was calculated to be 13.8 kcal/mole from the data obtained over a range of temperatures from 251 to 325°C. (auth)

1544

SORPTIVE PROPERTIES OF ANNEALED EQUIMOLECULAR MIXTURES OF $CaO-ZrO_2$ AND $MgO-ZrO_2$. E. N. Nikitin. Doklady Akad. Nauk S.S.S.R. 92, 617-20(1953) Sept. 21. (In Russian)

Mechanical mixtures of $CaO-ZrO_2$ and $MgO-ZrO_2$ were annealed at temperatures up to 1200° (at intervals of 100°). The specific surface area decreased with temperature. Ethanol was used as the material adsorbed, and sorption isotherms were plotted for the ZrO_2-CaO mixture. Temperature distributions for effective radii of ZrO_2-CaO and $MgO-ZrO_2$ were determined. (J.S.R.)

1545

ADSORPTION ISOTHERMS IN THE FORMATION OF ELECTROLYTIC DEPOSITS OF PROTACTINIUM ON GOLD. Christiane Ferradini (Institut du Radium, Paris, France). J. chim. phys. 50, 589-90(1953) Oct. (In French)

The fluorides of Pa at a pH of 5.9 in NaF were used to determine the adsorption isotherms of Pa on Au. The Pa concentration varied from 1.8×10^{-12} to 3.2×10^{-7} M. The critical potentials at the two concentration extremes were −1.43 and −1.37 v based on the standard calomel electrodes. The critical potentials of all the intermediate values studied were calculated, and the equilibrium potentials of Pa between the solution and the Au electrode were measured. Plotting the log of the Pa deposited as a function of the Pa in solution at equilibrium gives two lines of slope 0.9 and 2.0. (J.S.R.)

URANIUM AND URANIUM COMPOUNDS

*1546

Argonne National Lab.

ABSORPTION SPECTRA OF URANYL COMPOUNDS IN SOLUTION. Eugene Rabinowitch. Dec. 1953. 76p. Contract W-31-109-eng-38. (ANL-5173)

The absorption spectra of the free uranyl ion and its hydrolysis products, of uranyl ions complexed with inorganic and organic acid anions, and of uranyl compounds in organic solvents are discussed. The Raman and infrared spectra of uranyl salt solutions are also given. (J.S.R.)

ENGINEERING

*1547

Clarkson Coll. of Tech.

PERFORMANCE OF PACKED COLUMNS. [PART] 1. TOTAL, STATIC, AND OPERATING HOLDUPS. H. L. Shulman, C. F. Ullrich, and N. Wells. Jan. 8, 1954. 44p. Contract AT(30-1)-1463. (NYO-6096)

Total and static holdups have been measured for 0.5- and 1-in. ceramic Berl saddles, 0.5-, 1-, and 1.5-in. ceramic Raschig rings, and 1-in. C Raschig rings with air rates from 100 to 1000 lb/hr/ft^2 and water rates from 1000 to 10,000 lb/hr/ft^2. At a given liquid rate, total holdup is substantially independent of gas rate up to the loading point but increases rapidly with increasing liquid rate. Static holdup is independent of gas and liquid rates. Operating holdup is taken as the difference between total and static holdups. The holdup measurements and motion-picture observations of the flow of dye solutions through packings provide an explanation for the great differences observed when gas-phase mass-transfer rates are measured by absorption and vaporization methods. If the effective interfacial area for vaporization is assumed to be proportional to total holdup and the area for absorption assumed proportional to operating holdup, the ratio of the two mass-transfer rates should be equal to the ratio of the two holdups. The available mass-transfer data indicate

$$\frac{(k_G a)_{vap}}{(k_G a)_{abs}} = 0.85 \frac{h_t}{h_o}$$

where $(k_G a)_{vap}$ and $(k_G a)_{abs}$ are the mass transfer coefficients for vaporization and absorption respectively, and h_t and h_o are the total and operating holdups, respectively. The departure from equality of the two ratios can be explained by the observation that the static holdup is displaced slowly, resulting in additional effective area for absorption over that expected from the operating holdup alone. (auth)

*1548

Clarkson Coll. of Tech.

PERFORMANCE OF PACKED COLUMNS. [PART] 2. WETTED AREAS, EFFECTIVE INTERFACIAL AREAS, GAS PHASE MASS TRANSFER RATES (k_G) AND LIQUID PHASE MASS TRANSFER RATES (k_L). H. L. Shulman, C. F. Ullrich, A. Z. Proulx, and J. O. Zimmerman. Jan. 8, 1954. 54p. Contract AT(30-1)-1463. (NYO-6097)

A study was made to separate the volumetric mass transfer coefficients, $k_G a$ and $k_L a$, into their components k_G, k_L, and a so that the effects of variables could be determined separately for each component. Mass transfer rates for four packings, 0.5- and 1.5-in. Raschig rings and 0.5- and 1-in. Berl saddles, made of naphthalene, were determined by vaporization into air at gas rates from 100 to 1000 lb/hr/ft^2. The data were correlated by

$$\frac{k_G M_M P_{BM}}{G} = 1.195 \left[\frac{D_P G}{\mu_G (1-\epsilon)}\right]^{-0.36} \left[\frac{\mu_G}{\rho_G D_V}\right]^{-2/3}.$$

This correlation for k_G was used to determine the wetted areas of these packings when irrigated with water and to calculate the effective interfacial areas, a, from Fellinger's data for NH_3 absorption. These effective areas were then used to evaluate k_L from previously published $k_L a$ data, and a correlation was obtained for all packings as follows

$$\frac{k_L D_P}{D_L} = 25.1 \left[\frac{D_P L}{\mu_L}\right]^{0.45} \left[\frac{\mu_L}{\rho_L D_L}\right]^{0.5}.$$

The correlations for k_G and k_L and the effective interfacial area data make possible a more rigorous method for the design of packed columns than heretofore available. (auth)

1549

VISCOUS PROPERTIES OF PLASTIC LUBRICANTS AND ROTATIONAL RESISTANCE OF ANTI-FRICTION BEARINGS. G. V. Vinogradov and M. D. Bezborodko. Translated from Doklady Akad. Nauk S.S.S.R. 90, 1019-22(1953). 4p. (NSF-tr-165)

An investigation of the viscous properties of lubricants was made with a lubricant grease (solidoil) whose dispersive medium was a splindle distillate. Physical properties of the lubricant are given, and a standard precision ball bearing and a roller bearing were tested. It was found that the bearing resistances which depend on the kind of lubricant and vary with temperature and speed are determined by the viscosity-temperature and viscosity-speed characteristics of the lubricants. (J.E.D.)

AEROSOLS

*1550

Illinois Univ. Engineering Experiment Station

COLLECTION OF AEROSOLS BY FIBER MATS. TECHNICAL REPORT NO. II. J. B. Wong and H. F. Johnstone. Oct. 31, 1953. 108p. Contract AT(30-3)-28. (COO-1012)

An equation is proposed for the correlation of the collection efficiencies of fiber mats on the basis of an effective efficiency of the fibers in the mat. This equation predicts correctly the effects of mat thickness, fiber diameter, and the fiber volume fraction. A second equation is proposed for the correlation of the pressure drop across fiber mats on the basis of an effective drag coefficient of the fibers in the mat. This equation predicts correctly the effect of mat thickness, fiber diameter, and velocity through the mat. Experimental results are presented on the collection of H_2SO_4 aerosols by glass fiber mats with diameters of 3.51, 6.24, and 9.57 μ, and data are included from studies of the inertial impaction of homogeneous H_2SO_4 aerosol particles on Pt and on W wires of various diameters at several velocities of flow past the wires. Results are compared with previously published data. (C.H.)

*1551
Oak Ridge National Lab.
A SERVOMECHANISM FOR MEASURING AEROSOL PARTICLE SIZE AND A SERVOMECHANISM FOR CONTROLLING PARTICLE SIZE IN THE DIOCTYL PHTHALATE AEROSOL GENERATOR. R. Louis Bradshaw. Issued Jan. 29, 1954. 36p. Contract W-7405-eng-26. (ORNL-1660)

A servomechanism is described which continuously measures and records particle size of homogeneous aerosols in the range from approximately 0.1-μ to 0.2-μ radius. The principles of operation are explained, and limitations of the instrument are discussed with suggestions for improving the operation. Circuit diagrams and pictures of the instrument are shown. A servomechanism for controlling particle size in the dioctyl phthalate aerosol generator is described. The principles of operation are explained, and results of tests of the mechanism on an analog of the generator are discussed. Reasons are advanced for the unsatisfactory operation of the instrument on the actual generator and suggestions for improvement are given. (auth)

HEAT TRANSFER AND FLUID FLOW

*1552
Johns-Manville Corp.
THERMAL INSULATION DEVELOPMENT. HEAT LOSS FROM SIR MARK A PIPING DUE TO PIPE HANGER AND CALROD PENETRATIONS THROUGH LK INSULATION. (SUPPLEMENTAL REPORT). S. Speil. Nov. 30, 1953. 4p. Contract AT(36-1)-8. (AECU-2756)

Laboratory tests on 2- and 5-in. pipes covered with a composite Thermoflex RF and LK-61 insulation showed that the heat loss from 850° piping is increased by 0.02 Btu/hr/°F temperature difference (pipe surface to air) for each pair of Calrod heater leads that penetrate the insulation. On both 2- and 8-in. pipes with recommended insulation, the effect of these penetrations corresponds to an increased heat loss of approximately 6%. The effect of pipe hangers was calculated rather than determined experimentally because of the variety of hanger configurations. The average heat loss per hanger for 2-in. piping was 45 Btu/hr which corresponds to the heat loss from a 5-in. length of pipe insulated according to recommendations. Data summarize the heat losses from various hanger configurations used with 8-in. piping. (auth)

1553
THERMAL CONTRACTION OF A SPLIT HOLLOW CYLINDER. W. Karush (Univ. of Chicago) and A. V. Martin (Univ. of Calif., Berkeley). J. Appl. Phys. 24, 1427-31 (1953) Dec.

A long hollow cylinder which is radially split along its entire length is considered. When such a cylinder is heated, its inner radius undergoes a change δa. The cylinder is called stable if $\delta a \leq 0$. An approximate solution for δa is derived and is used to determine conditions for stability. The pressure against the inner surface required to prevent the contraction δa is also derived. (auth)

MATERIALS TESTING

*1554
DuPont de Nemours, E. I., and Co. Explosives Dept., Atomic Energy Div.
EDDY-CURRENT INSPECTION METHODS: TRIP REPORT—THE DR. FÖRSTER INSTITUTE, REUTLINGEN, GERMANY. R. C. McMillen. Nov. 1953. 46p. Contract AT(07-2)-1. (DP-13)

Test instruments developed at the Dr. Förster Institute, Reutlingen, Germany, were considered for possible application to Savannah River nondestructive inspection problems involving stainless steel and Al tubing. None of the equipment can solve these problems without modifications. Several instruments are recommended for further study in connection with their use with Al tubing. None will be considered for use with stainless steel at this time. (auth)

1555
INVESTIGATION OF LUBRICATING ACTION IN DEEP DRAWING USING A MODEL. S. Ya. Veiler, L. A. Shreiner, and P. A. Rebinder. Translated from Doklady Akad. Nauk S.S.S.R. 73, 511-13(1950). 6p. Available from Henry Brutcher (Trans. No. 3195), Altadena, Calif. (AEC-tr-1764)

The proposed method, which is based on the principle of deep drawing of a strip with a thinning wall, makes it possible not only to measure the tangential drawing forces, as is usually done, but also to determine in the process of drawing the normal, radially compressive forces at various degrees of deformation. The method makes it possible to study the effectiveness of lubricants employed in deep drawing and to determine the capacity of a metal for deep drawing under laboratory conditions. With the aid of this method, it has been established that the principal characteristics of lubricating action are the effective drawing stresses σ_i and the nominal coefficient of friction P/N. The method makes it possible to investigate lubricants of the most diverse consistency, as well as to determine the lubricating action of metallic coatings at various temperatures. This method can be used both for developing formulas for lubricants and coolants and as a control method for plant laboratories. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

*1556
Massachusetts Inst. of Tech.
STUDY OF METAL-CERAMIC INTERACTIONS AT ELEVATED TEMPERATURES. F. H. Norton, W. D. Kingery, F. A. Halden, and M. Berg. Sept. 30, 1953. 37p. Contract AT(30-1)-1192. (NYO-6289)

Reactions of TiN and TiC with Fe, Ni, Mo, Si, Nb, Ti, and Zr were investigated at 1600 and 1800°C. Reaction interfaces and powder mixtures were studied microscopically and with x-ray techniques. Formation of a new phase, solution in the metal phase, penetration along grain boundaries, and extensive solid solutions were observed in various systems. Equipment and techniques are described for preparing small ceramic spheres of good quality and studying their sintering characteristics during the initial

stages of sintering. A microscope furnace was employed to observe directly the sintering between spherical particles. Soda lime-silica glass was found to sinter with viscous flow, Cu by volume diffusion, and NaCl by evaporation–condensation. Pure Al_2O_3 and ZrO_2 were found to exhibit sintering only when impure or subjected to pressure. These results were analyzed in regard to the sintering process. (auth)

*1557

Massachusetts Inst. of Tech.

STUDY OF METAL-CERAMIC INTERACTIONS AT ELEVATED TEMPERATURES. PROGRESS REPORT [FOR APRIL 1 THROUGH JUNE 30, 1953]. F. H. Norton, W. D. Kingery, et al. July 1, 1953. 6p. Contract AT-(30-1)-1192. (NYO-6291)

Further study of systems to be investigated for surface and interfacial energy is in progress. The surface tension of Pt has been determined in He as 1865 ± 50 dynes/cm at 1770°C. Further studies of NaCl sintering are in agreement with the previously reported evaporation-condensation mechanism. (For preceding period see NYO-3145.) (auth)

CORROSION

*1558

Battelle Memorial Inst.

SOLUBILITY OF THE PRODUCTS OF CORROSION OF STAINLESS STEEL IN 600 F WATER. H. A. Pray and E. F. Stephan. Nov. 30, 1953. 12p. Contract W-7405-eng-92. (BMI-891)

The solubilities of the major elements from the products of corrosion of Type 347 stainless steel and analytical-grade Fe in 600°F water were determined. Analyses were made of water samples taken both at room temperature and at 600°F. The tests were run in degassed water, water containing 200 ml/l of O_2, water containing 200 ml/l of H_2, and water adjusted to pH 10 with LiOH. The amounts of Fe, Ni, and Cr found in the water samples at 600°F in all tests were less than 0.03 ppm. The room-temperature samples were essentially the same. Because the solubilities were below the limit of analysis, it was not possible to determine the temperature coefficient of solubility. Under conditions involving a temperature differential, and even if the temperature coefficient of solubility is high, the extremely low solubilities would require very large volumes of water in order to form an appreciable quantity of solid product from true solution. The presence of loosely adhering corrosion product on samples and autoclave indicates the possibility of transport of this solid material from the place of origin to another area by suspension, rather than in true solution, especially in a flowing system. (auth)

*1559

Hanford Works

EVALUATION OF A METHOD OF DETECTING ANODIC AND CATHODIC AREAS ON ALUMINUM SURFACES. R. E. Wilson. Nov. 23, 1953. 18p. Contract W-31-109-eng-52. (HW-30066)

The objective of this work was to evaluate the usefulness of this device for studies of the corrosion of Al and the amount of time needed to develop it for general use. The equipment and the method show promise, but it is estimated that it would take about 1 yr to develop them and that the value of such a program is doubtful. The detection of fresh scratches which penetrate the oxide surface film is easily done. The detection of the natural anodic cells is very doubtful. Large inclusions or other metals electroplated on the sample show up very well, but small inclusions do not emerge from the background. It is felt that further work on the development of the rotogenerator should be stopped until such time as more concrete results have been established by this method. (auth)

*1560

Carbide and Carbon Chemicals Co. (K-25)

METAL MATERIALS FOR HANDLING AQUEOUS HYDROFLUORIC ACID. M. Schussler, A. G. Dobbins, and D. S. Napolitan. Issued Dec. 7, 1953. 70p. Contract W-7405-eng-26. (K-1080)

Studies using over 150 samples have been conducted on Ag brazed Monel, welded Monel, and welded Cu-Ni specimens exposed to 48% and 5% HF at a test temperature of 150°F. A number of Ag brazing alloys were investigated in the tests, as were several selected heat treatments of welded specimens. In addition, limited tests were conducted on Illium R, Pb, and Ag. The test procedure permitted an evaluation of the extent of attack that occurred on the specimens in the condensed vapor above the bath, at the liquid line, and when completely immersed in the test solutions. Silver was the only metal tested that had satisfactory resistance to attack under all of the test conditions. Monel with either welded or Ag brazed joints and Cu-Ni with welded joints showed little attack when totally immersed in the test baths. However, these alloys suffered a severe loss at and above the liquid level line. There are other limitations which can affect the life of joints in these conditions of service. (auth)

*1561

Livermore Research Lab., Calif. Research and Development Co.

AQUEOUS STATIC CORROSION OF ALUMINUM ALLOYS COUPLED TO STAINLESS STEEL AND ZIRCONIUM AT 350°F. P. O. Strom, M. H. Boyer, and L. M. Litz. Jan. 1954. 14p. Contract AT(11-1)-74. (LRL-74)

The corrosion of several commercial Al alloys, electrically coupled to type 302 stainless steel and to Zr, was studied at 350°F in pure water. Those Al alloys coupled to steel showed appreciably higher initial rates of attack than those coupled to Zr. Roughly equal rates were observed once the protective film of corrosion product had formed. Long-term corrosion rates were about the same as for uncoupled Al alloys, about 0.35 mil/yr at this temperature. (auth)

1562

Delaware Univ.

DETERMINATION OF THE PRESENCE AND INFLUENCE OF AN ANODIC PHASE UNDER CONDITIONS OF APPLIED STRESS. FINAL REPORT COVERING PERIOD NOVEMBER 27, 1951 TO SEPTEMBER 30, 1953. THE STRESS CORROSION OF BRASS AND SOME OTHER ALLOYS BY THE SMITH AND PINGEL METHOD. J. M. Douy and R. L. Pigford. Nov. 16, 1953. 102p. Contract DA-36-034-ORD-694. (NP-5009)

Introduction of a trace of $ZnCl_2$ to the solution permits a steady potential to be obtained by a Zn specimen in contact with a KCl solution. A grain boundary of Zn was found to be anodic to the adjacent grain by 58.6 mv, based on a single pair of measurements. The potential of cartridge brass varies erratically in the presence of air, even when traces of CuCl, $CuCl_2$, or $ZnCl_2$ are introduced. In the absence of air, the potential of brass varies regularly and generally increases initially after a short decrease, reaching a steady value. This steady value is a function of the location on the specimen, being different for different metal grains. The grain boundary is anodic with respect to the grains. More cathodic potentials of the order of 0.25 v, often observed after prolonged exposure of the metal, correspond to the oxidized metal (presence of corrosion products). More anodic potentials of the order of 0.7 v correspond to the fresh metal, but lower potentials are observed for some grains even when they are oxide free. Application of external stress does not have much direct effect on the surface potential. The stress probably acts indirectly by breaking

the protective oxide film at weaker points (generally grain boundaries) where fresh, highly anodic metal appears. This causes acceleration of corrosion usually intergranular in nature. The present report gives support to the film theory of stress corrosion. The Smith and Pingel method gives satisfactory results, provided O_2 is thoroughly eliminated from the specimen, the solution, and the surrounding atmosphere. (auth)

1563

THEORY OF THE OXIDATION OF METALS AND METAL ALLOYS. (Zur Theorie der Oxydation von Metallen und Metall-Legierungen). K. Hauffe. Translated by R. C. Murray from Werkstoffe u. Korrosion 2, 131-9; 221-31; 243-9(1951). 58p. (RAE-Trans-390; ATI-127094)

The theoretical and experimental work on corrosion and tarnishing related to the view of these processes as essentially conditioned by diffusion of metal ions through the film of corrosion product to the external corroding atmosphere are reviewed. Special attention is paid to the theories of Wagner on corrosion and Mott and Cabrera on tarnishing. The phenomenon of internal corrosion of alloys is described. In order to achieve high corrosion resistance, an alloying element should nave an ionic radius about the same size as that of the main metal, so that its corrosion product should have a high solubility in the corrosion product of the foundation metal, and also its charge must be of the right magnitude depending on the type of defect structure (hole or excess conducting) found in the lattice of the corrosion product of the main metal. With this principle as a guide, various possibilities for future work on improving the corrosion resistance of Ag and Ni-Cr alloys are put forward, and a scheme of work (suitable for an institute working on corrosion problems) outlined. There are 99 references, many of them multiple. (auth)

GEOLOGY AND MINERALOGY

1564

Wisconsin Univ.

THE CORRELATION OF THE MADISON LIMESTONE BY THE THERMOLUMINESCENCE METHOD (thesis). FINAL REPORT. Charles William Pitrat. Aug. 1953. 38p. Contract AT(11-1)-178. (AECU-2747)

This test of the thermoluminescence method of limestone correlation has led to the following conclusions. The correlation of thick limestone units requires the use of a method which will bring out the systematic variations. The best method found so far for showing such systematic variations is the double-ratio in conjunction with a three point moving average. Because impurities and conditions of deposition have a part in determining glow curve shape, and because these factors are likely to vary greatly over long distances, not too much should be expected from thermoluminescence correlations over long distances. Thermoluminescence correlations are likely to be most valuable in restricted areas where the details of the thickening and thinning of formations are in doubt. Tentative correlations are made involving the Conger Spring section in the Confusion Range, the Teton Pass, the Leatham Hollow, the Uinta, and the Willow Creek sections, but it cannot be stated with certainty that these correlations are correct. (J.E.D.)

1565

Geological Survey

RESULTS OF RECONNAISSANCE FOR URANIUM IN NONMARINE CARBONACEOUS ROCKS IN PARTS OF CALIFORNIA, IDAHO, NEVADA, OREGON, UTAH, AND WASHINGTON DURING 1951 AND 1952. Donald C. Duncan. Mar. 1953. 26p. (TEM-444-A)

Nonmarine carbonaceous rocks, including lignitic shales, coal, and peat were tested at about 30 localities in Calif., Idaho, Nev., Oreg., Utah, and Wash. Rocks ranging in age from Carboniferous to Quaternary were examined, although the principal attention was given middle and late Tertiary lignites of the northern part of the Great Basin. Most carbonaceous rocks examined contained essentially no U, but lignitic shales in the Goose Creek district, Idaho, a thin carbonaceous shale near Hagerman, Idaho, and a small peat deposit in Davis Co., Utah, contained more than 0.003% U. (auth)

1566

RADIOACTIVITY OF RIVERS AND LAKES IN PARTS OF GARLAND AND HOT SPRING COUNTIES, ARKANSAS. Robert H. Arndt and Paul K. Kuroda (Univ. of Arkansas, Fayetville). Econ. Geol. 48, 551-67 (1953) Nov.

A wide range of Rn content in surface waters was noted incidental to studies of Rn in spring and well waters of Hot Springs and Potash Sulphur Springs, Garland County, Arkansas. Subsequently a reconnaissance survey of radioactivity of nearby streams and lakes showed the Rn contents of streams range from 0.0084 to 1.07 mμc/l of H_2O, and those of lakes range from less than 0.001 to 0.123 mμc. Streams flowing over Ordovician black shales contained an average of 0.275 mμ Rn/l of H_2O. Those flowing over black Stanley shale of Mississippian age contained an average of 0.046 mμc Rn/l of H_2O. The radon content in Potash Sulphur Creek where it flows over the U-bearing rocks of the Potash Sulphur Springs syenite complex ranged from 0.09 to 3.16 mμc/l of H_2O. Ground water in a drill hole in U-bearing rock contained an average of 58.75 mμc/l of H_2O. Waters from small springs were shown to lose as much as 41.3% of total Rn content in the first 4 ft of surface flow below the point of emergence. The methods of Rn determination in the field are believed applicable to prospecting for low-grade uraniferous deposits, especially in black shale areas, in areas of heavy overburden, and in areas of saturation by ground water where ordinary detection devices may be somewhat limited. (auth.)

1567

STUDIES ON SASKATCHEWAN URANIUM ORES. F. D. F. Talbot and J. W. T. Spinks (Univ. of Saskatchewan, Saskatoon, Canada). Precambrian 26, No. 12, 11-13, 15-16, 35 (1953) Dec.

The new U discoveries in Saskatchewan which prompted this study of the beneficiation of low-grade U ores are reviewed briefly. Radiometric, x-ray-diffraction, and radioautographic studies of the ores show that the mineral uraninite is present in the ore in the form of small crystals 0.2 mm in size. These crystals are associated with biotite and widely disseminated throughout the rock. On grinding, the uraninite appears in the fines early in the grinding process. Flotation tests on the ore were carried out with various collectors and with and without metallic ions as activators. Tables show the percent U_3O_8 in the concentrate and the percent recovery of U_3O_8 in each case. (A.G.W.)

METALS AND METALLURGY

1568

Illinois Univ.

THE INFLUENCE OF TEMPERATURE AND RATE OF STRAIN ON THE PROPERTIES OF METALS IN TORSION. C. E. Work and T. J. Dolan. Sept. 1952. 156p. Contract AF-33(038)-21587. (AD-3634)

An experimental study was made to determine the effect of temperature and rate of strain on the strength, ductility, and energy-absorbing capacity of seven different structural metals in torsion. Cylindrical specimens 0.25 in. in diam.

were tested at four different constant strain rates from 0.0001 to 12.5 in./in./sec and at four different temperatures from room temperature up to 1200°F. Two series of tests were conducted: specimens were held at the test temperature for ½ hr before loading and specimens were given a 200-hr aging treatment at the test temperature before testing. Torque, angle of twist, and time were continuously recorded, and the torsional properties determined. The detailed results are presented in three-dimensional charts and analyzed in terms of the mechanisms altering the material behavior. It was found that an increase in strain rate caused an increase in strength, whereas an increase in temperature reduced the strength of all metals except in the blue-brittle temperature range for steel. Extremely great ductility was exhibited by some of the metals at the highest elevated temperatures employed, particularly at the slower rates of straining. The 200-hr aging treatment had no appreciable effect on the properties of most of the metals tested; significant changes were produced only in the Al alloys at 400 and 600°F and in alloy steel at 1200°F. The experimental observations were compared with several theories that have been proposed to express mathematically the effects of strain rate and temperature on mechanical properties. By proper selection of empirical constants, several equations involving a general relation for flow stress or new parameters of a "temperature-modified" strain rate or a "velocity-modified" temperature were found to express approximately the variations obtained in mechanical properties. (auth)

1569

Los Alamos Scientific Lab.

METAL EQUATION OF STATE FROM SHOCK WAVE STUDIES. [John M. Walsh]. [1953?]. Decl. Jan. 18, 1954. 47p. Contract W-7405-eng-36. (AECD-3611)

A method is presented for determining equation-of-state data for metals from the velocity of shock waves produced by the detonation of high explosives as the shock waves approach the free surface of a metal plate and from the velocity of the free surface itself after the shock wave is reflected as a rarefaction wave. Data from a series of experiments, incorporated with hydrodynamic and thermodynamic relations, are used to determine a pressure-compression curve for shock waves which propagate into the normal metal, or Hugoniot, curve. This curve is used in the determination of related equation-of-state data. The high-explosive assembly, a high-speed sweep camera used to record shock and free-surface velocities, and an assembly for the measurement of shock velocity are described and illustrated. Experimental data for Al, Cu, and Zn are listed in tables and presented graphically. Data on effects of material rigidity on results are presented in an appendix. (C.H.)

*1570

Institute of Engineering Research, Univ. of Calif., Berkeley

FUNDAMENTALS OF GLASS TO METAL BONDING. TECHNICAL REPORT NO. 3. WETTABILITY OF ADDITIONAL METALS BY SODIUM SILICATE GLASS. David W. Mitchell, Joseph A. Pask, and Alexander Kaminski. June 1, 1953. 17p. Contract AT-(11-1)-34. (AECU-2780)

The results of experiments are described in which the wetting of Co, Cr, Fe, Mo, Nb, Ni, Ta, Th, U, V, W, and Zr by Na_2SO_3 glass was studied. Details of apparatus and methods of experimentation are briefly reviewed. (For part I see COO-53, for part II see AECU-2088.) (J.E.D.)

*1571

Battelle Memorial Inst.

FABRICATION AND EVALUATION OF THIN CLAD SHEETS OF MOLYBDENUM. M. H. LaChance, C. M. Craighead, and R. I. Jaffee. Nov. 2, 1953. 40p. Contract W-7405-eng-92. (BMI-888)

Techniques for producing thin sections of clad Mo and for edge protecting the sheared edges of the composite sheet are described. A method for selecting cladding materials was developed. This method consisted of simulating the conditions existing when clad Mo is exposed at elevated air temperatures. The high-temperature air oxidation of Fe, Co, and alloys containing significant quantities of Fe or Co was drastically accelerated by contact with Mo and its oxidation products. Oxidation of Cr, Ni, and high-Ni alloys was relatively mild in the presence of Mo and MoO_3. Iron-base-alloy claddings proved to be markedly inferior to high-Ni claddings for service at elevated air temperatures. Of the cladding materials tested, Mo was best protected by the 80 wt. % Ni-20 wt. % Cr alloy. (auth)

*1572

Ames Lab.

MEASUREMENT OF THE ELECTRICAL RESISTANCE OF METALS AND ALLOYS AT HIGH TEMPERATURES. Premo Chiotti. Dec. 28, 1953. 25p. Contract W-7405-eng-82. (ISC-434)

An a-c potentiometric method for measuring the electrical resistance of metals and alloys at very high temperatures is described. The potential developed between two probes which make contact with the test piece is balanced against a potential developed across the secondary of a current transformer. The primary of the current transformer is connected in series with the test piece. The test piece in the form of a bar, is mounted between water-cooled Cu electrodes and is heated by passing a high 60-cycle current through it. The resistance is measured directly. A furnace and automatic recording and control instruments which can be used in conjunction with this method are described. (auth)

1573

Battelle Memorial Inst.

THE EFFECT OF MICROSTRUCTURE ON THE MECHANICAL PROPERTIES OF TITANIUM ALLOYS. INTERIM REPORT NO. 4. MICROSTRUCTURE AND HEAT TREATMENT OF TITANIUM-CARBON ALLOYS. H. R. Ogden, F. C. Holden, and R. I. Jaffee. Oct. 30, 1953. 51p. Contract DA-33-019-ORD-280. (NP-5004)

Titanium-base alloys containing a compound-forming element are discussed. Carbon was chosen as the compound-forming element because it not only forms a compound, TiC, but it also has a limited solubility in both α and β titanium. The addition of C to Ti results in a peritectoid-type system. The solubility of C is higher in the α phase than in the β phase in the temperature range of interest. Below the peritectoid temperature the solubility of C in α titanium decreases with decreasing temperature. This type of system permits many microstructural and heat-treatment variations which may influence the properties of the alloys. The study of how the microstructure variations affect mechanical properties is presented. In addition, the effect of microstructure on the mechanical properties of H-free, high-purity Ti is described. Previous work on unalloyed Ti, was done on material which contained 90 ppm H. (auth)

1574

Institute of Engineering Research, Univ. of Calif., Berkeley

AN ANALYSIS OF THE PHENOMENON OF HIGH TEMPERATURE CREEP. Oleg D. Sherby and John E. Dorn. Jan. 15, 1954. 42p. Contract N7-onr-295, T. O. II, Technical Report No. 34. (NP-5018)

A review is made of some of the facts now known about high-temperature creep. It is shown that the activation energy for creep for a given metal is insensitive to dilute solid-solution alloying, grain size, dispersions of stable intermetallic compounds, cold working, temperature,

stress, and structure. It is further shown that the energies of activation for creep of pure metals are approximately equal to the best known values of the activation energies for self-diffusion. The creep-rate dependence of metals on the applied stress for constant structure is reviewed. Application of this method for the creep of dilute Al alloys reveals that the logarithm of the creep rate is a linear function of the true stress. The slope of the stress-logarithm creep-rate curves is found to be a constant for a given alloy independent of the structural changes occurring during creep, but the slope is found to increase linearly with atomic percent of solute addition. A model for creep is presented wherein it is suggested that the rate-controlling process is that of recovery of barriers from the path of moving dislocations and that the removal of these barriers is controlled by atomic-diffusion processes. (auth)

1575

Metals Research Lab., Carnegie Inst. of Tech.
ELECTROCHEMICAL STUDIES OF NON-AQUEOUS MELTS. QUARTERLY PROGRESS REPORT [FOR] PERIOD ENDING SEPTEMBER 15, 1953. Robert H. Mehl and Gerhard Derge. Nov. 15, 1953. 18p. Contract AT(30-1)-1024. (NYO-3695)

The specific conductance of molten PbS was measured from the melting point (1120°C) to 1200°C. The specific conductance is about 165 mho/cm and exhibits a positive temperature coefficient, resembling the apparent semiconductance observed in molten Cu_2S. The specific conductance of Cu_2S in contact with molten Cu was measured from 1100 to 1500°C. This reduced both the specific conductance and the positive temperature coefficient of Cu_2S by about 0.5. This evidence is inconclusive in deciding between the Richardson redox mechanism and the pseudometallic bond semiconductance hypothesis for conductivity in molten Cu_2S. Very precise cell efficiency data for electrolysis of molten Cu_2S-FeS mixtures show that these systems can be only very slightly ionized (less than 5%). This is strong evidence in favor of the pseudometallic bond hypothesis for these systems. Cell efficiency data for molten Cu_2S-CuCl and Cu_2S-CuS systems demonstrate the existence of some ionic conduction, in agreement with the results of conductivity measurements. Further data for the specific conductance of molten Cu_2S-CuCl mixtures confirm results presented in NYO-3693 indicating the strong effect of ionic CuCl in decreasing the electronic conduction in Cu_2S. The apparatus described in the previous progress reports has been adapted for measuring the mobility of the Fe^{++} ions in Fe silicate slags using radioactive Fe anodes. (For preceding period see NYO-3694.) (auth)

1576

Metal Cutting Lab., Mass. Inst. of Tech.
VISUAL STUDY OF THE MACHINING OF TITANIUM. N. H. Cook. Nov. 1953. 23p. Contract DA-19-020-ORD-2425. (WAL-401/172-6)

A visual study of machining was carried out in order to demonstrate some of the reasons why tool life is relatively short when cutting Ti. The physical and thermal properties of Ti are such as to allow three distinctly different types of chip formation: continuous, discontinuous, and a new type denoted as nonhomogeneous. A nonhomogeneous chip is similar to a discontinuous chip in that thin zones of highly deformed material separate the chip into segments. On the other hand, chips exhibiting nonhomogeneous strain differ from the conventional discontinuous chip in that they consist of a continuous ribbon rather than being composed of a number of discrete particles. Their outward appearance thus resembles that of the conventional continuous type of chip. Inhomogeneous chip formation predominates at practical cutting speeds when Ti alloys are machined under normal conditions. Conditions which are detrimental to tool life are discussed, and it becomes apparent that the continuous type of chip formation is preferable. Various physical and metallurgical changes are considered which should aid in obtaining continuous chip formation. (auth)

1577

CORROSION OF ALUMINUM CONDENSERS IN A BATH FOR THE ELECTRODEPOSITION OF ZINC. A. I. Levin, A. V. Pomosov, and T. N. Rogatkina. Zhur. Priklad. Khim. 26, 1245-51(1953) Dec. (In Russian)

The rate of corrosion of Al in a bath for the electrodeposition of Zn is dependent on many factors and especially on the presence of impurities in the electrolyte. The effect of various impurities, such as Cu^{+2}, Sb^{+3}, Pb^{+3} [sic], Fe^{+3}, F^-, Cl^-, or NO_3^-, is tabulated. Extensive data are given on the corrosive effects of F^- and H_2SO_4. The corrosion behavior of Al changes with its position in the electrolytic bath. (J.S.R.)

1578

THE NEW RADIOMETALLURGY LABORATORY AT HANFORD. Nucleonics 12, No. 1, 26-7(1954) Jan.

The new radiometallurgy laboratory at the Hanford Works in Richland, Wash., is described and illustrated. The structure provides complete facilities for metallurgical studies of irradiated metals. Research will center around solution of problems of fuel structure, bonding, metal preparation and canning, deterioration of fuel elements, and similar problems concerning fuel slugs from the Hanford reactors. (C.H.)

1579

STRUCTURAL CHANGES IN ALUMINUM WITH RELAXATION OF STRESS. B. M. Rovinskii and V. G. Lyuttsau. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk, 1616-21 (1953) Nov. (In Russian)

The structural changes in Al on relaxation of stress were observed by x-ray-diffraction techniques. With application of stress in the elastic range, the number of interference spots decreased. On relaxation of the stress, the number of interference spots increased because of increase in crystal imperfections and grain numbers. (J.S.R.)

1580

THE STRUCTURE OF THIN ALUMINUM-SILVER LAYERS. H. Göttsche (Institut für Angewandte Physik, Hamburg, Germany). Z. Physik 134, 504-16(1953). (In German)

In the electron interference pattern from thin, vacuum-evaporated Al-Ag layers (30 wt. % Ag) a cubic interference "satellite" appears. It originates partly from a hexagonal phase in the condensate, which in the cubic phase occupies a fixed position ([111] parallel to [0001]) and partly from lattice faults which are caused by the parallel development of the cubic and hexagonal phase. (tr-auth)

PHYSICS

*1581

Los Alamos Scientific Lab.
COMPARISON OF INDUCTANCE OF ELECTRICALLY SHORT TRANSMISSION LINES. Douglas Venable, Charles F. Beckett, and Clarence J. Brown. [1953?] 5p. Contract W-7405-eng-36. (AECU-2790)

Application is made of the voltage amplification of a partially resonant LCR circuit wherein the inductance is that of a short-circuited transmission line. An external tuning capacitance is used which is large compared with distributed line and circuit capacitances. The generator

frequency is chosen slightly off resonance so that the resistance term in the impedance is negligible. Two such circuits are combined into a bridge. A schematic diagram of the complete unit, including the d-c and r-f power supplies, the feed-back r-f voltage regulator, and the bridge, is shown. This scheme is particularly suited to comparing the inductances of 2 coaxial cables or 2 small coils whose absolute inductances are less than 10^{-6} h. Inductance differences of RG54/U cables of identical length were found to be less than 0.5% with an error of about 10%. (J.A.G.)

*1582

Los Alamos Scientific Lab.

EXPERIMENTAL STUDIES OF TAYLOR INSTABILITY. John C. Allred, George H. Blount, and John H. Miller, III. Nov. 1953. 72p. Contract W-7405-eng-36. (LA-1600)

Experimental observations of Taylor instability have been made on interfaces of fluids under uniform and under impulsive accelerations. The theoretical results of Pennington and Bellman and of Birkhoff and Ingraham concerning the effects of surface tension and viscosity on the growth by surface tension is found to be in essential agreement with the theory. The growth coefficients, α ($\eta = \eta_0 \cosh \alpha t$), were measured to be less than those predicted by the linear theory in cases where growth of a wave was observed. The discrepancy is perhaps due to effects connected with the necessarily finite amplitude of the wave when measurements can be made. A new mechanism leading to the restraint of growth is proposed, that of the existence of a density gradient of finite width at an interface, as opposed to a true discontinuity of density. The importance of Helmholtz instability in the development of the shape of the interface is demonstrated. Turbulent mixing of the fluids at sufficiently great Reynolds number is observed. The mixing, producing a region of density gradient, provides a final inhibitory effect on the growth. The wavelength of most rapid growth at an interface has been observed in experiments with impulsive acceleration, again in agreement with theory. Some experimental refinements for future observations of impulsive accelerations are suggested. (auth)

1583

Surface Chemistry Lab., Lehigh Univ. Inst. of Research

THE ADSORPTION OF POLAR ORGANIC MOLECULES ON METAL SURFACES IN RELATION TO LUBRICATION AND CORROSION INHIBITION. TECHNICAL REPORT NO. 1 [FOR] MAY 1952–DECEMBER 1953. F. H. Healey, A. C. Zettlemoyer, J. J. Chessick, and A. V. Fraioli. 42p. Contract DA-36-034-ORD-935. (NP-4996)

The design of the adsorption apparatus, the preparation of pure Fe, and the reduction of surface oxide are reported. The results of adsorption measurements on oxide-coated Fe and the reduced Fe are given, as well as preliminary measurements on TiO_2. The construction of the apparatus for measurements of static friction in the presence of organic vapors is described. The results of the friction measurements are discussed in the light of the adsorption and heat of immersion data. (auth)

1584

Alfred Univ.

A SONIC METHOD OF MEASURING YOUNG'S MODULUS OF ELASTICITY AT HIGH TEMPERATURE. W. B. Crandall and C. A. Bryant. Dec. 15, 1953. 14p. Contract N6-ori-143. (NP-5054)

A method of measuring Young's modulus of elasticity employing a sonic technique is described. This method has the advantage of being usable over a fairly wide range of temperatures, is nondestructive, and is capable of reproducing values to within ±1%. An audio-frequency generator is used to drive a long thin bar suspended by a Pt wire from a speaker cone. Another wire attached to a variable reluctance pickup needle suspends the bar at the other end. An oscilloscope is used to detect the resonant frequency of the bar from the pickup device. A simple relationship is used to relate the resonant frequency of the bar to Young's modulus. (auth)

1585

Radiation Lab., Univ. of Calif., Berkeley

CHEMICAL THERMODYNAMICS OF AQUEOUS THIOSULFATE AND BROMATE IONS (thesis). Howard Charles Mel. Sept. 1953. 108p. Contract W-7405-eng-48. (UCRL-2330)

In an effort to clear up gross inconsistencies in the thermodynamic data for $S_2O_3^{-2}$ ion, the equilibrium constant was determined as a function of temperature for the new reaction: $2Ag\ (c) + S_2O_3^{-2} = Ag_2S\ (\alpha) + SO_3^{-2}$. A calorimetric heat of oxidation of $S_2O_3^{-2}$ with Br_3^- has also been measured. From these sources, the thermodynamic properties have been calculated for $S_2O_3^{-2}$ at 298.16°K with the results: $\Delta H_f^0 = -154.0$ kcal/mole, $\Delta F_f^0 = -122.4$ kcal/mole, $S^0 = 14.1$ e.u. Discussion is given, particularly from the standpoint of the theories of aqueous entropies. Discrepancies in thermodynamic data for BrO_3^- ion were felt to be primarily due to an inaccurate value for the heat of formation. This quantity has been redetermined from a calorimetric study of the reduction of BrO_3^- with I^- and the reduction with Br^-. Combining these heats with other heat and entropy data, the results for BrO_3^- at 298.16°K, $\Delta H_f^0 = -18.3$ kcal/mole and $\Delta F_f^0 = 2.1$ kcal/mole are found. These values are discussed with respect to other experimental data. (auth)

1586

KINETIC COEFFICIENTS IN HELIUM II. I. M. Khalatnikov. Translated from Zhur. Eksptl' i Teoret. Fiz. 23, 8-20(1952). 13p. Available from the Dept. of Scientific and Industrial Research, London. (CTS-32)

From the kinetic equations for excitation in He II, its equations of motion are derived. The problem of the kinetic coefficients in He II is clarified. General expressions are obtained to determine the following coefficients: one coefficient of the first viscosity, three coefficients of the second viscosity, and, finally, a coefficient corresponding to the heat-conduction coefficient in ordinary substances. A detailed analysis of the kinetic equation of the elementary excitations in He II has made it possible to clarify the question of its kinetic coefficients. This work has revealed that, apart from the coefficient of the first viscosity and the three coefficients of the second viscosity, He II has a further kinetic coefficient which is analogous to the coefficient of heat conductivity for ordinary substances. This coefficient relates the temperature gradient to the flow of heat. An analysis of the kinetic equation for elementary excitations in He II was made. Such an analysis enables the hydrodynamic equations of He II and the general expressions for the flows of energy and impulse to be found. (auth)

1587

THE PATH OF THE DEFORMATION PROCESS AS A BASIC CHARACTERISTIC OF THE DEFORMED STATE OF A PLASTIC BODY. S. I. Gubkin and Ye. S. Bogdanov. Translated from Doklady Akad. Nauk S.S.S.R. 88, 967-70(1953). 5p. (NSF-tr-125)

The physical and geometric deformations which are necessary to give a complete description of the deformed state are discussed. It is concluded that the only deformation variable proportional to the expended work and to the change in the physical state of the body is the physical intensity of deformation. Therefore, the dependence of the intensity of the state of stress on the process path is the sole characteristic of the plastic behavior of a metal. In the general case this dependence is represented by a set of curves, one

coördinate being the intensity of the state of stress and the other the deformation path. For stable and very plastic metals, when the state of stress does not affect the resistance to deformation, the family of curves merges into one general curve, which is a universal characteristic of the material. (J.A.G.)

1588

ON THE LAW OF DAMPING OF THE LUMINESCENCE OF SOLID ORGANIC SUBSTANCES. V. A. Yastrebov. Translated from Doklady Akad. Nauk S.S.S.R. 90, 1015-18(1953). 4p. (NSF-tr-164)

An investigation was made of the kinetics of emission of solid organic substances and the possibility of obtaining recombination luminescence with organic molecules. (J.E.D.)

1589

EFFECT OF TEMPERATURE ON LIGHT ABSORPTION IN THIN AND EXTRA-THIN LAYERS OF SILVER. A. G. Gumenyuk. Translated from Doklady Akad. Nauk S.S.S.R. 91, 783-6(1953). 5p. (NSF-tr-171)

The spectral curves of absorption of Ag layers of various thickness, before and after heat treatment, showed that the character of the absorption spectrum depends on the thickness of the layers. (J.E.D.)

1590

THE VELOCITIES OF FUNDAMENTAL PARTICLES. L. L. Whyte. Phil. Mag. (7)44, 1303-4(1953) Nov.

The localization of space and time for meaningful determinations of the transit time of lighter particles such as electrons, positrons, and mesons is discussed. It is pointed out that correct measurements of electron velocity involve replacing static or periodic fields by separate signals, space-time localized by the use of mechanical rotors, deflectors charged at successive moments by a single pulse, or pairs of counters recording single-particle lags. Experiments of this nature on neutrons and atomic or molecular beams are not considered applicable to the lighter particles. (K.S.)

1591

INTERPRETATION OF THE VIRTUAL LEVEL OF THE DEUTERON. S. T. Ma (National Research Council, Ottawa, Canada). Revs. Mod. Phys. 25, 853-60(1953) Oct.

Some of the definitions of the virtual level are elucidated from the viewpoint of the theory of S matrix (scattering matrix) and the theory of R (derivative) and Q matrices. After a brief general review, attention is confined to the following definitions: (1) definitions which are based on the analogy of the S virtual state with S bound state and which fit in a simple way into the theory of the S matrix; (2) a definition that identifies the S virtual level with the lowest S resonance level according to the theory of the R matrix. From a general formula connecting the S and R matrices, a simple connection is derived between the two kinds of definitions. (auth)

1592

THERMAL CONDUCTIVITY OF COPPER BETWEEN 0.25°K AND 4.2°K. James Nicol and T. P. Tseng, (Ohio State Univ., Columbus). Phys. Rev. 92, 1062-3(1953) Nov. 15.

The thermal conductivity of Cu has been determined in the range 0.25 to 4.2°K. The Cu sample was a polycrystalline, high-purity magnet wire. The temperature dependence of thermal conductivity was found to be linear down to 0.25°K, with a proportionality constant $\alpha = 1.76$ w/cm/deg^2. This linearity is interpreted as a demonstration of the electronic character of thermal conductivity and the linear dependence of electronic specific heat on absolute temperature. (K.S.)

1593

THE MAGNETIC SUSCEPTIBILITY OF GERMANIUM. D. K. Stevens and J. H. Crawford, Jr. (Oak Ridge National Lab., Tenn.). Phys. Rev. 92, 1065-6(1953) Nov. 15.

The specific magnetic susceptibility, χ, of p- and n-type Ge, with various impurity concentrations, has been measured as a function of temperature for the range 65 to 300°K. The Faraday method was used throughout, and the crystals were single crystals cut as cubes 0.5 cm on edge. (K.S.)

1594

HEAT OF MIXING OF He^3 IN He^4. H. S. Sommers, Jr., W. E. Keller, and J. G. Dash (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 92, 1345-6(1953) Dec. 15.

The integral heat of mixing for an 8.6% solution of He^3 in He^4 at 1.0°K, measured by an adiabatic free-expansion process, is 0.17 cal/mole of solution. Combined with the free energy of mixing, obtained from vapor pressure data, this shows that at this temperature the bulk of the excess free energy of mixing is due to the heat of mixing. (auth)

ASTROPHYSICS

1595

COSMIC-RAY PRODUCTION OF HELIUM IN METEORITES AND THEIR AGES. J. C. Dalton, F. A. Paneth, P. Reasbeck, and S. J. Thomson (Univ. of Durham, England) and K. I Mayne (Clarendon Lab., Oxford, England). Nature 172, 1168-69(1953) Dec. 26.

Results of an investigation of meteorites having a ratio of He^3 to He^4 of less than 0.31 are presented. It was assumed, on the grounds of previous work, that the ratio for He from cosmic rays was between 0.40 and 0.25, and thus the radiogenic He^4 contents were calculated. From the U and Th contents, the probable ages were estimated. (J.A.G.)

COSMIC RADIATION

1596

ON THE EXISTENCE OF UNSTABLE CHARGED PARTICLES OF HYPERPROTONIC MASS. A. Bonetti, R. Levi Setti, M. Panetti (Univ. of Milan, Italy), and S. Tomasini (Univ. of Genoa, Italy). Nuovo cimento 10, 1736-43 (1953) Dec. 1. (In English)

Further evidence is presented in favor of the existence of charged unstable particles of hyperprotonic mass. In two cases the decay product is a fast, light particle, in one case it is slow proton. The decay schemes $\Omega_\pi^\pm \rightarrow n + \pi^\pm$ and $\Omega^+ \rightarrow p + \pi^\circ + Q$ are proposed for the two types of events respectively. They are possibly alternative modes of decay of the same type of H particle. The evidence available from photographic emulsion and cloud chamber experiments is discussed. (auth)

1597

ORIGIN OF COSMIC RAYS AND RADIOASTRONOMY. V. L. Ginzburg. Uspekhi Fiz. Nauk 51, 343-92(1953) Nov. (In Russian)

A review is given of all recent work on the origin of cosmic rays. The electron component of cosmic radiation and the motion of charged particles in interstellar space are discussed. The hypothesis of the stellar origin of cosmic rays is criticized, and supernova and new stars are suggested as the probable source. 55 references. (J.S.R.)

1598

SHOWERS OF AT LEAST TWO ELECTRONS PRODUCED IN LEAD BY COSMIC RAYS. C. Milone (Univ. of Catania, Italy). Nuovo cimento 10, 1744-6 (1953) Dec. 1. (In Italian)

The coincidence and anticoincidence events are calculated and tabulated as a function of the thickness of the Pb shields. Indicating the anticoincidence function as F(s) and the coincidence function as E(s), the ratio of F(s) to E(s) is compared with that of previous authors. There appears to be an excess of photons with respect to electrons at relatively low energies. (J.S.R.)

1599
AN ANALYSIS OF THE ELECTRON PAIRS PRODUCED IN NUCLEAR EMULSIONS BY COSMIC RAYS PHOTONS. G. Baroni (Univ. of Rome, Italy), A. Barsellino, and L. Scarsi, (Univ. of Genoa, Italy), and G. Vanderhaeghe (Univ. Libre de Bruxelles, Brussels, Belgium). Nuovo cimento 10, 1653-61 (1953) Dec. 1. (In English)

A comparison has been made between the theory of electron pair production by photons and experimental data for energies up to 400 Mev. The following points have been analyzed: 1) energy partition between the two members of the pair; 2) statistical distribution of the momentum transfer to the pair; and 3) distribution of the angle of divergence of the pair. (auth)

1600
THE EXISTENCE OF NON-STABLE CHARGED PARTICLES WITH MASS EXCEEDING THE MASS OF PROTONS. A. Alikhanyan, V. Kirillov-Ugryumov, N. Shostakovich, V. Fedorov, and G. Merzon. Doklady Akad. Nauk S.S.S.R. 92, 719-21(1953) Oct. 1. (In Russian)

Two events from cosmic radiation were recorded in a Wilson cloud chamber of the stopping of positively charged particles. By impulse and range measurements the mass was determined to be 2230 ± 150 m_e, greater than that of a proton. (J.S.R.)

1601
SPATIAL DISTRIBUTION OF CHARGED PARTICLES NEAR THE AXIS OF EXTENSIVE ATMOSPHERIC SHOWERS OF COSMIC RAYS. Yu. N. Vavilov, S. I. Nikol'skii, and E. I. Tukish. Doklady Akad. Nauk S.S.S.R. 93, 233-6(1953) Nov. 11. (In Russian)

Measurements were made at 3860 m above sea level. Graphs are shown of individual showers, of showers with $(7 \pm 4) \times 10^4$ particles, and of showers with different energies. (J.S.R.)

1602
SUPERNOVAE AND NEW STARS AS ORIGIN OF COSMIC AND RADIO EMISSION. V. L. Ginzburg. Doklady Akad. Nauk S.S.S.R. 92, 1133-6(1953) Oct. 21. (In Russian)

The hypotheses of the origin of cosmic rays are evaluated, and it is suggested that supernovae and new stars are the only origin in accord with experimental data. (J.S.R.)

1603
DETERMINATION OF THE MASS OF COSMIC RAYS BY THEIR IONIZING POWER. A. I. Alikhanyan and V. M. Kharitonov. Doklady Akad. Nauk S.S.S.R. 92, 1125-8(1953) Oct. 21. (In Russian)

By a comparison of the impulse and the ionizing power of cosmic particles with mass between that of a π meson and a proton, the mass of the light particles was determined to be 531 m_e and that of the heavy particles 910 m_e, in good agreement with masses of 568 and 933 m_e obtained by other methods. These results are low because of the possible influence of weakly ionizing particles. (J.S.R.)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

1604
ON THE STRUCTURE OF CRYSTALS OF MARTENSITE IN HARDENED STEEL. M. P. Arbuzov, L. I. Lysak, and E. [Ye.] G. Nesterenko. Translated from Doklady Akad. Nauk S.S.S.R. 90, 375-7(1953). 3p. (NSF-tr-153)

The study of the width and intensity of the lines of isolated crystals of martensite shows that in free martensite there are no distortions of the second kind, the size of the regions of coherent scattering is small (2 to 3×10^{-6} cm), and the distortions of the third kind are in the direction of the c axis as well as in the direction of the a axis. The mean-square shift along the c axis is twice as large as that along the a axis. (J.E.D.)

1605
AN IMPROVED DETERMINATION OF THE CRYSTAL STRUCTURE OF β-URANIUM. Charles W. Tucker, Jr. and Peter Senio (Knolls Atomic Power Lab., Schenectady, N. Y.). Acta Cryst. 6, 753-60(1953) Oct.

An improved determination of the crystal structure of β-U reveals that the subsidiary layers in the structure are definitely rumpled. The magnitude of the rumpling is a definite departure from the nearly perfect layering. The question of the rumpling of the main layers in the structure is not resolved by the new work. Thus, the question of whether the crystal is non-centrosymmetric (space group P4nm) or centrosymmetric (space group P4/mnm) is not settled, although the centrosymmetric space group is perhaps more probable. The new determination reveals an unusually short interatomic distance of 2.59 A. The only comparable distance in a metal of this type occurs in the α-neptunium structure. The β-uranium structure is compared in detail, as far as is possible, with refined σ-phase structures. It is found that although the structures may have the same space group, there are real differences in atomic positions, particularly of atoms in the subsidiary layers. The contention of Thewlis that there are intensity differences between β-phase powder patterns from the pure metal and from low Cr alloys at 720°C is considered in detail. The major intensity discrepancy for the powder pattern of the low Cr alloy is found not to occur in the single crystal data from an alloy of identical composition. After a consideration of this and other factors, it is concluded that the β-phase structures for the low-Cr alloys and the pure metal are identical. (auth)

ELECTRICAL DISCHARGE

*1606
Radiation Lab., Univ. of Calif., Berkeley
FORMATIVE TIME DELAY OF HIGH-VACUUM SPARKS. Harry G. Heard. Nov. 6, 1953. 24p. Contract W-7405-eng-48. (UCRL-2251)

Formative time delays of the order of 10^{-9} sec have been measured for impulse-initiated vacuum sparks between d-c biased electrodes at pressures of the order of 10^{-7} mm Hg. Gap current-vs.-time photographs show a distinct current rise, which may or may not lead to a vacuum spark. Data show that vacuum sparking continues under special conditions where clump, ion-electron chain reaction, and conduction-electron cathode heating mechanisms cannot apply. Calculations show that anode vaporization from field-emission electrons agrees with the formative time-lag measurements. The time distribution of initiating events following a voltage impulse exhibits a random fluctuation about a mean value. The average delay increased with electrode spacing and decreased with applied voltage. Results are discussed in terms of possible vacuum spark-initiation mechanisms. (auth)

1607
THE DECAY OF THE SPACE CHARGES IN INTERMITTENT DISCHARGES IN NEON AND ARGON. D. Brini and P. Veronesi (Univ. of Bologna, Italy). Nuovo cimento 10, 1662-72 (1953) Dec. 1. (In English)

The influence of the gas pressure and of the distance of the electrodes on the process of the decay of space charges in intermittent discharges in Ne and A is examined. The decay times appear in both gases to be of the order 10^{-3} sec, and are, for the distances and pressures examined, sensibly proportional to the pressure. The possible causes of the high values of such times are discussed, and the various parts of the static characteristic of a discharge tube are related to the functioning of counters and periodic

discharges of the 1st and 2nd kind, which might exist there. (auth)

1608

THE MATHEMATICAL THEORY OF ELECTRICAL DISCHARGES IN GASES. B. VELOCITY-DISTRIBUTION OF POSITIVE IONS IN A STATIC FIELD. Taro Kihara (Univ. of Tokyo, Japan). Revs. Mod. Phys. 25, 844-52(1953) Oct. (cf. NSA 6-3611).

The discussion of a previous article (Revs. Mod. Phys. 24, 45(1952)) is extended to the mathematical theory of the stationary velocity distribution of positive ions in a static, homogeneous electric field in the absence of a magnetic field. (K.S.)

ELECTRONS

*1609

Ames Lab.

TRANSMISSION OF 0-40 KEV ELECTRONS BY THIN FILMS WITH APPLICATION TO BETA-RAY SPECTROSCOPY. R. O. Lane and D. J. Zaffarano. [Jan. 7, 1954] 21p. Contract W-7405-eng-82. (ISC-436)

The transmission of electrons in the energy range 0 to 40 kev by thin plastic and metal films with surface densities of 0.023 to 1.57 mg/cm^2 has been measured in detail. The range-energy data resulting is prescribed fairly well by Bethe's average energy-loss theory. One of the films was used as a G-M counter window in a β spectrometer. The application of the transmission data to the β spectrum obtained for Pm^{147} gave some overcorrection, as judged by the Fermi plot, which was attributable to the emission of secondary electrons by the window. (auth)

1610

MOTION OF FAST ELECTRONS IN A MAGNETIC FIELD. A. A. Sokolov and I. M. Ternov. Translated from Doklady Akad. Nauk S.S.S.R. 92, 537-40(1953). 4p. (NSF-tr-137)

The trajectories of fast electrons in a magnetic field are analyzed by a quantum mechanical treatment, where the components of the vector potential, in cylindrical coordinates, are used in a solution of the Dirac equation. (K.S.)

1611

POLARIZATION OF ELECTRONS BY SCATTERING. IV. Norio Ryu (Kyusyu Univ., Fukuoka, Japan). J. Phys. Soc. Japan 8, 804-5(1953) Nov.-Dec. (cf. NSA 5-3254 and 8-603)

Experiments previously reported (J. Phys. Soc. Japan 7, 125-30(1952)) on electron polarization by double scattering in Au foils have been repeated at a higher energy and at an angle of 135°. Plural scattering effects were small, and no appreciable change in the results was noted. (K.S.)

1612

INVESTIGATION OF ELECTRON EMISSION BY CLEAVAGE OF HEAVY BODIES IN A VACUUM. N. A. Krotova and V. V. Karasev. Doklady Akad. Nauk S.S.S.R. 92, 607-10(1953) Sept. 21. (In Russian)

According to the electric theory of high polymer glasses, electron emission could be caused by placing the glass in high voltage fields and a high vacuum. The apparatus used is described with a schematic diagram. Electron emission was detected in quartz, sugar, quartzitic piezoelements, tourmaline, zinc blende, and mica. (J.S.R.)

1613

ELECTRON SHOWER PROCESSES AT VERY HIGH ENERGIES. L. Landau and I. Pomeranchuk. Doklady Akad. Nauk S.S.S.R. 92, 735-8(1953) Oct. 1. (In Russian). (Cf. NSA 8-891.)

It is shown that the Bethe-Heitler equations are inapplicable to the theoretical analysis of radioionization processes in which the energy is very high, $\omega \ll E$ or $\omega \sim E$, where ω is the frequency. (J.S.R.)

1614

UPON THE EQUATION OF MOTION OF ELECTRONS IN CLASSIC ELECTRODYNAMICS. P. Caldirola (Univ. of Milan, Italy). Nuovo cimento 10, 1747-52(1953) Dec. 1. (In Italian)

The nonrelativistic equation of Lorentz and the Dirac relativistic equation for the motion of an electron seem inadequate. The nonrelativistic equation $M_0/\tau_0\,[\nu(t) - \nu(t - \tau_0)] = F(r;t)$ is proposed. It is derived from the second series of postulates. The equation is integrated for each particular case. (J.S.R.)

1615

THERMOELECTRON EMISSIONS FROM THIN PLATES OF THORIUM OXIDE AND THORIUM ON MOLYBDENUM. A. R. Skul'man and A. P. Rumyantsev. Doklady Akad. Nauk S.S.S.R. 93, 455-8(1953) Nov. 21. (In Russian)

1616

EXPERIMENTS ON THE g-FACTOR OF THE ELECTRON. F. Bloch (Stanford Univ., Calif.). Physica 19, 821-31(1953) Sept. (In English)

The g-factor of electrons was measured for electrons bound in atoms. The most precise experimental determination was made from atomic beam magnetic resonance measurements of the hfs of H atoms in an external magnetic field. It was found to be $g_e = 2(1.001146 \pm 0.000012)$, in excellent agreement with the most recent theoretical values. A somewhat less accurate determination, the determination of transition frequencies between the Zeeman levels of the hfs of various atomic states, gave a value $g_e = 2(1.00114 \pm 0.00004)$. Two arrangements are proposed for the measurement of the g-factor with free electrons; effect of a magnetic field upon the polarization of electrons and the magnetic resonance of slow electrons in a magnetic field. (J.S.R.)

1617

NOTE ON THE SPIN PARAMAGNETISM OF A FREE ELECTRON GAS. N. H. March (The University, Sheffield, England) and B. Donovan (Northern Polytechnic, London, England). Proc. Phys. Soc. (London) A66, 1104-8(1953) Dec.

The effect of exchange on the spin paramagnetism of a free electron gas is discussed. It is shown that in general the exchange terms have a marked effect on the susceptibility and can be legitimately neglected only at extremely high temperatures. A comparison is made with the results of a simple treatment due to Stoner, and qualitative similarities are apparent. (auth)

GASES

1618

Los Alamos Scientific Lab.

PRECISION MEASUREMENT OF DETONATION AND STRONG SHOCK VELOCITY IN GASES. Herbert T. Knight and Russell E. Duff. Jan. 8, 1954. Decl. Jan. 18, 1954. 12p. Contract W-7405-eng-36. (AECD-3612)

A system is described for the measurement of detonation and strong shock velocities in gases which is based on the conductivity existing behind the wave. Contact with the wave is made through pins consisting of two 36-mil Cu wires set 0.1 in. apart in teflon plugs mounted flush with the inside of the experimental tube. When the wave passes a pin, the gas becomes part of a series circuit made up of a 0.001-μf capacitor charged to 300 v and a 30,000-ohm signal resistor. Any number of these pin circuits may be connected in parallel across a single signal resistor if a crystal diode is added to each circuit to prevent the early pins from shorting later ones. The signals are transferred to 300-ohm cable by a cathode follower. They may then be connected directly to the plates of a raster-type oscilloscope, or they may be sent

to a pulse transformer-coupled amplifier to sharpen the leading edge of the signals. The arrival time of a wave at a pin can be determined with an accuracy of almost 10^{-8} sec. A check of the system was made by measuring the velocity of five detonation waves in a 40 to 60 aceytlene-oxygen mixture. Typical signals from the detonation of mixtures of C_2H_2-O_2, H_2-O_2, and CO-O_2, a typical oscilloscope trace, a wiring diagram for the pulse shaper, and a photograph showing the detonation tube, teflon plug, and modified cable connector are included. (auth)

*1619

Los Alamos Scientific Lab.

STATISTICAL UNCERTAINTIES IN THE RADIOGRAPHIC DETERMINATION OF GAS DENSITIES. Douglas Venable and Leo F. Perry. Dec. 1953. 18p. Contract [W-7405-eng-36]. (AECU-2785)

The uncertainties in the measurement of gas densities by flash radiographic techniques arise from the statistical fluctuation of the quanta absorbed in the specimen and detector, the inherent instrumental uncertainties, and inadequate time resolution. For small numbers of useful quanta the statistics of absorption can constitute an important term. This has been investigated. The absorption statistical uncertainties in measuring densities in N and A have been worked out for the continuous x-ray spectrum of W as a function of peak energy and path length for the charge delivered to the x-ray source and for the useful solid angle subtended by the detector at the target. For purposes of this work, the intensity distributions determined experimentally were employed. In order to check the predictions, measurements were made using only the 25-kv spectrum of W. (auth)

*1620

Oak Ridge National Lab.

DEVELOPMENT OF THE PIPE-LINE GAS SEPARATOR. J. A. Hafford. Issued Nov. 2, 1953. Decl. Jan. 14, 1954. 22p. Contract W-7405-eng-26. (ORNL-1602)

A pipe-line gas separator is described which consists of a means of imparting rotation to the liquid by means of vanes or a volute and a section of pipe with a void space in the center to provide a free surface for the gas to travel to and from where it will be removed. The energy of rotation can be partially recovered with vanes or a volute at the discharge end of the separator. Results are presented of a series of tests on various components of a model of the separator in which several runs were made to test vanes and volutes of different types for energy conversion and recovery and for gas-removal efficiency. Tests were also run on the most feasible means of controlling the size of the void. (C.H.)

INSTRUMENTS

*1621

Livermore Research Lab., Calif. Research and Development Co.

AN AUTOMATIC SWEEP UNIT FOR SINGLE CHANNEL PULSE HEIGHT ANALYZERS. G. D. O'Kelley. Issued Oct. 1953. 15p. Contract AT(11-1)-74. (MTA-39)

A sweep unit for automatic control of a single-channel pulse-height analyzer bias is described. The unit is linear, stable, and compact enough to be included in most single-channel pulse-height analyzers. Commercially available stepping switches are employed for stepping a decade resistor network. After completing a bias voltage scan, the stepping system resets to the starting voltage and repeats the sweep indefinitely. Several applications of the sweep unit to scintillation spectroscopy are described. (auth)

1622

Baird Associates, Inc.

FINAL REPORT COVERING THE PERIOD JUNE 15, 1948 TO DECEMBER 31, 1953. Robert O'B. Carpenter, Ralph McDonough, W. A. Patterson, and Norman Hapgood, Jr. 119p., 1 illus. Contract N8onr-60801. (NP-5015)

A complete summary is presented of work done toward development of tunable narrow-band optical filters and various modifications of the Fabry-Perot interferometer with subsequent application to isotope concentration measurement by spectrochemical techniques. Specifically, the application to the analysis of D-H mixtures is considered. The determination of D_2O by infrared absorption techniques is discussed. Abstracts of the eight technical reports which have been issued previously are given to aid in presenting a more composite picture of the project. (For preceding period see NP-4912.) (L.M.T.)

1623

THE FOCUSSING AND MAGNETIC ANALYSIS OF A BEAM FROM A RADIO-FREQUENCY ION SOURCE. A. N. Banerjee (Bose Institute, Calcutta, India). Indian J. Phys. 27, 523-32(1953) Oct.

The operation of a radiofrequency type of positive ion source is described, in which the excitation was produced by a 22-mc/sec, 200-watt r-f oscillator. Using an extraction voltage of 2.2 kv, a total positive-ion current of 175 μa was delivered at the target. The extraction voltage beam-current characteristics show that this current can be increased further to attain a saturation value with increasing extraction voltage. By suitably adjusting the ratio of the extraction voltage to the focusing voltage, a 6- to 10-mm diameter beam could be realized in the region of accelerator space. A magnetic analysis of the beam revealed that its atomic ion content was more than 60%. (auth)

ISOTOPES

*1624

Oak Ridge National Lab.

ISOTOPIC ABUNDANCES OF PALLADIUM. J. R. Sites, George Consolazio, and Russell Baldock. Dec. 7, 1953. 11p. Contract W-7405-eng-26. (ORNL-1652)

The recently developed mass spectrometer high-temperature source oven has been applied to the determination of the isotopic abundances of Pd as part of a program for assaying the separated isotopes of the Pt metals. Discrepancies with previously published data have been found, and the newly determined isotopic abundances of natural Pd are reported. (auth)

ISOTOPE SEPARATION

1625

Atomic Energy Research Establishment, Harwell, Berks (England)

METHODS OF MEASURING THE GASEOUS $B^{10}F_3$-$B^{11}F_3$ SEPARATION CHARACTERISTICS OF THERMAL DIFFUSION COLUMNS, AND THE VISCOSITY AND DIFFUSION COEFFICIENT DATA FOR BF_3. W. H. Denton. Mar. 1950. 18p. (AERE-G/R-511)

1626

Colorado Univ., Engineering Experiment Station

SEPARATION OF ISOTOPES BY ELECTROLYSIS. YEARLY REPORT. F. A. Rohrman, J. H. Andrews, D. H. Thurnau, and W. F. Utlaut. [1953] 43p. Contract AF 18 (600)-440. (NP-4986)

As the isotopes of H_2 can be separated by simple electrolysis of aqueous electrolytes, it was thought possible that other elements might be partially separated by electrolysis. Aqueous solutions of Ni salts were used because Ni plating techniques are well known, the tracer isotope Ni^{63} is readily available in a pure form, the isotope has a long half life, and it emits a soft, nondangerous β radiation. Isotopic enrichment was detected by radioactive tracer techniques. The plating baths and equipment were described in detail.

The sample preparation and counting procedure were outlined. The effect of electrical, mechanical, and chemical variables on the isotopic enrichment are being studied. Preliminary results indicate that stirring has no effect but that temperature does. (J.S.R.)

MASS SPECTROGRAPHY

1627

Arkansas Univ. Engineering Experiment Station

DEVELOPMENT OF AN INSTANTANEOUS GAS ANALYZER. PART I. RF MASS SPECTROMETER. Mar. 1953. 38p. Contract AF 33(616)-15. (AD-14091)

A r-f mass spectrometer utilizing Bennett's design has been constructed, and its satisfactory operation proved. Electronic circuits have been developed with emphasis on simplification and integration of the assembled units, capable of operating for long unattended periods with high stability. An investigation of the performance of the r-f mass spectrometer tube with respect to various gases has been made. The optimum performance of the mass spectrometer tube with respect to the various grid potentials and pressure in the tube has been investigated. (auth)

1628

Atomic Energy Research Establishment, Harwell, Berks (England)

ELECTRON-OPTICAL DESIGN OF A MASS-SEPARATOR. P. A. Sturrock. Oct. 1953. 11p. (AERE-T/M-89)

The design of a magnetic mass separator which is to focus a line source into a line image is investigated. It is assumed that all rays of the beam leave the line source normally. The curvatures of the entrance and exit boundaries of a uniform magnetic field are adjusted so that broadening of the image due to second-order aberrations is eliminated, and the position of the plane of best focus is determined. (auth)

*1629

Knolls Atomic Power Lab.

SOME COMMENTS ON THE MASS SPECTROMETRIC ANALYSIS OF THE ISOTOPES OF LITHIUM USING A SURFACE IONIZATION SOURCE. T. L. Collins and F. M. Rourke. Nov. 9, 1953. 22p. Contract W-31-109-Eng-52. (KAPL-999)

An attempt has been made to measure the isotope abundance of Li using a surface-ionization source in a mass spectrometer. Ion beam intensities of less than 10^{-14} amp were employed in an effort to avoid extreme sample depletion and its consequent effects on observed isotopic ratio. Samples of normal Li, as well as Li samples having abnormal isotopic ratios, were studied. The results of the investigation indicate that the surface-ionization method of analysis discussed in this report is unreliable for Li assay. Reasons for this unreliability are discussed. (auth)

MATHEMATICS

1630

NUMERICAL SOLUTION OF THE SCHRÖDINGER EQUATION. A. v. Mohrenstein (Freiburg Univ., Germany). Z. Physik 134, 488-503(1953). (In German)

A numerical method for the solution of the Schroedinger equation is described. It is a further development of the Frost method. In the case of complex atoms and molecules, the method can be used as the last approximation step of a Hartree calculation. Moreover, a numerical method for the multiple integration of general functions is proposed. As a simple example, the problem of the ground state of He and H_2 is considered. The eigenvalues were calculated to be -2.9050 Hartree units (H.E.) and -1.1730 H.E., respectively. The experimental values are -2.9035 and -1.1743 H.E., respectively. (tr-auth)

MEASURING INSTRUMENTS AND TECHNIQUES

*1631

Los Alamos Scientific Lab.

LARGE-VOLUME LIQUID SCINTILLATORS AND THEIR APPLICATIONS. C. L. Cowan, F. B. Harrison, and F. Reines. [1953?]. 18p. Contract W-7405-eng-36. (AECU-2789)

The scintillation counter described has a volume of 300 l and the shape of a circular cylinder 75 cm in diameter and 75 cm high. Ninety photomultipliers are arranged around the periphery. The tubes are connected in spirals, and alternate spirals are hooked together so as to form two banks, which are run in coincidence to reduce the effects of tube noise and afterpulsing. A thin Cu shield surrounding the outside serves as an electrostatic shield and protects personnel against high voltage. Two fillings, one of toluene–terphenyl–α–naphthyl phenyl oxazole and one with the same ingredients plus methanol and Cd propionate, have been used. Calibration of the instrument and applications for the detection of neutrinos, γ rays, and neutrons are discussed. (C.H.)

*1632

Ansco Div., General Aniline and Film Corp.

DEVELOPMENT OF A WAVELENGTH-INDEPENDENT RADIATION MONITORING FILM. FINAL REPORT. Aug. 1, 1953. 68p. Contract [W-31-109-eng-38], Subcontract 31-109-38-139. (ANL-5168)

The purpose of this project was to develop a photographic film, or combination of films, sensitive in the range 0.1 to 30.0 r as measured in air, the sensitivity expressed in reciprocal roentgens to be as nearly independent of wavelength as possible in the energy range of approximately 20 kev to 1 Mev. The first efforts to reach the desired goal consisted of modification of available commercial emulsions to reduce the dependence of sensitivity on wavelength. Although considerable progress was made using this approach, it was later abandoned in favor of a system involving a combination of a film and a pair of fluorescent intensifying screens. The film and screens were designed so that the response of the combination is very nearly wavelength independent in the desired range. In addition to having the proper balance between sensitivity to the fluorescent light from the screens and sensitivity to direct x radiation, it is also important that the film have a minimum of low-intensity reciprocity law failure to minimize the variation in sensitivity with exposure time in the range 1 sec to 40 hr. The film designed under the contract meets the requirements when processed in a special developer consisting of Ansco Liquadol x-ray developer and a developer retarder. The intensifying screens are pressure-molded from a mixture of p-terphenyl and Lucite. The fluorescence efficiency of the screens is greatest for high energy radiation—to which the film alone is least sensitive—and least for low-energy radiation—to which the film alone is most sensitive. This complementary relation between the fluorescence efficiency of the screens and the film sensitivity is a major factor in producing wavelength independence. The film-screen combination fills the major requirements for radiation monitoring in the laboratory, in manufacturing areas, and in the field. In the effective energy range from 20 kev to 1 Mev and for doses from 0.14 to 1.2 r, the maximum error in measurement is approximately ±30%. The range of exposures which can be measured is approximately 0.02 to 10 r. The upper limit can be extended to 30 r by a slight increase in emulsion thickness. (auth)

*1633

Hanford Works

AN IONIZATION CHAMBER METHOD FOR ABSOLUTE

GAMMA RAY DOSE MEASUREMENTS. I. T. Myers. Oct. 14, 1953. 30p. Contract W-31-109-Eng-52. (HW-29732)

An absolute ion chamber method of measuring γ-ray dosages was developed utilizing condenser ion chambers with a Model 70 Victoreen "r" meter. The non air-equivalence of the walls was allowed for by an interpolation between readings from identical graphite and Al chambers. Corrections were applied for wall absorption, for lack of standard temperature and pressure conditions, and for a small extra cameral effect. In order to develop the standard chambers, a study of pertinent ion chamber parameters was undertaken. The parameters investigated included wall material, wall thickness, and chamber size. (auth)

*1634

Mound Lab.

A WINDOWLESS PROPORTIONAL CHAMBER FOR ABSORPTION MEASUREMENTS. (INFORMATION REPORT). L. B. Gnagey. May 15, 1953. 8p. Contract AT-33-1-GEN-53. (MLM-857)

The method of converting a Nuclear Measurements Corp. hemispherical proportional chamber mechanism into a unit suitable for making absorption measurements is described. Drawings of a chamber, a piston, and an absorber mounting ring and a sample spacer are also given. The utility of the absorption chamber and the circuitry involved are not discussed. (auth)

1635

Department of Mines and Technical Surveys. Mines Branch (Canada)

DECADE TUBE SCALING CIRCUITS. J. C. Baker and G. G. Eichholz. Nov. 12, 1953. 26p. (NP-5001; TR-113/53)

Various compact scaling tubes available have been examined and compared for their utility in nuclear counting applications. Pulse requirements and counting performance are contrasted, and a few possible circuits for the Dekatron, Nomotron, and Philips EIT tubes are discussed. The tubes available at present are surveyed, and the properties and characteristics of those that are on the market at a reasonable price and are of particular interest in nuclear work are compared. Some circuits that have been developed for pulse counting are described, but no special attention is paid to those tubes and circuits that have their primary uses in computer circuits. (auth)

1636

ABSOLUTE MEASUREMENT OF HIGH ENERGY β RADIATION WITH THE 4π-COUNTER TUBE. F. G. Houtermans (Univ. of Göttingen, Germany) and L. Meyer-Schützmeister and D. H. Vincent (Max Planck-Gesellschaft, Göttingen, Germany). Z. Physik 134, 1-8(1952). (In German)

An absolute measurement of the β radiation of the radioactive isotopes Na^{24}, P^{32}, K^{42}, and Pr^{142} was made with the 4π-counter tube. With this method of measurement independence from the scattering of the emitted β particles was achieved. The only source of error, the absorption of the β radiation into the material itself, was without influence as only the high-energy radiation was investigated. Good agreement was found with the measurements obtained at the AERE, Harwell, England. (J.S.R.)

1637

INVESTIGATION OF THE DISCHARGE SLOPE AND THE POST-DISCHARGE PHENOMENA IN GEIGER-MÜLLER TUBES WITH THE AID OF X-RAY IMPULSES. P. Müller (Univ. of Jena, Germany). Ann. Physik 13, 110-35(1953). (In German)

After a short survey of other work in which several methods for measurement of the dead time and recovery time as well as the post-discharge slope of a counter tube are described, a description of an x-ray impulse apparatus and different test counters is given. Measurements of the phenomena of dead time and recovery time and some new observations are described. In the measurement of the post-discharge phenomena, some peculiarities were noticed. The influence of the space charge was treated theoretically, and the separate role of the ion shell was shown in an approximation calculation. The results are compared with those of other workers. (tr-auth)

1638

TRAJECTORIES AT THE MINIMUM OF IONIZATION INSCRIBED IN AN EMULSION OF FINE GRAIN PREPARED IN THE LABORATORY. Pierre Demers. Compt. rend. 237, 1228-30(1953) Nov. 16. (In French)

The preparation and development of a fine-grain emulsion which shows traces of ionization in the neighborhood of the minimum is described. (tr-auth)

1639

METHOD OF MEASURING THE ACTIVITY OF α EMITTERS BY CINENUCLEOGRAPHY. Odette Roehrich-Goussu. Compt. rend. 237, 1230-2(1953) Nov. 16. (In French)

The α activity of Po was measured cinenucleographically. The method consists of counting the tracks of α rays which are found in a certain number of fields of a microscope. If the measurement is made in a region of the plate where the spacing of the trajectories is exactly equal to the dimension of the perpendicular source for a velocity such that the average density can be considered a constant, the activity is given by $a = 1/3.72 \times 10^4 L\nu\sigma$ where L is the dimension of the perpendicular source, ν the linear velocity of the source, and σ the average density of the tracks. If the plate is scanned for tracks from one end to the other perpendicular to the trajectories p, and n is the number of tracks and d the diameter of the field, the activity is given by $a = 1/3.72 \times 10^4$ nv/pd. By the first method, a = 189 μc, and by the second a = 198 μc. (J.S.R.)

1640

STUDY OF THE EFFECT OF VARIOUS METHODS OF DEVELOPMENT ON THE FORMATION OF FOG IN NUCLEAR EMULSIONS. G. Alvial C. (University of Chile, Santiago, Chile). Nuovo cimento 10, 1616-22 (1953) Dec. 1. (In Italian)

The formation laws of fog in nuclear emulsions of different sensitivities is studied as a function of the correspondent development method. (auth)

1641

VARIATIONS IN THE β-PARTICLE COUNTING PROPERTIES OF DIAMOND. N. G. Trott (King's College, Univ. of London, England). Proc. Roy. Soc. (London) A220, 498-513(1953) Dec.

The electrical counting response of nine small type 2 diamonds to Bi^{210} β particles has been examined at room temperature and in the temperature range 288 to 601°K. At room temperature, five of the diamonds could be very strongly activated by β-particle irradiation; in the activated state the counters did not polarize in the dark, even when operated for long periods at constant field. The counting efficiency in the activated state was estimated. Deactivation could be produced by irradiation with white light. The counting rate of activated diamonds varied considerably with temperature. For heating rates of about 1.5°K/min, counting-rate maxima were found in several specimens at temperatures of approximately 300 and 440°K. An attempt has been made to estimate the depths of traps believed to be responsible for these maxima; the values obtained are about 0.5 and 0.8 ev. It is suggested that the activation process may be attributed, in part, to trap saturation. (auth)

1642

ON THE USE OF THE SCINTILLATION COUNTER AS A GAMMA RAY SPECTROMETER, USING STILBENE

CRYSTAL. Sobhana Dhar and Sunil Kumar Sen (Calcutta Univ., India). Indian J. Phys. 27, 483-90(1953) Oct.

A preliminary investigation on the use of the scintillation counter as a γ-ray spectrometer is reported here, using the organic crystal stilbene and the IP28 photomultiplier tube. Pulse-height distribution curves have been obtained for the Co^{60} source with a thin Pb radiator and a thin Al foil, respectively. Co^{60} emits two γ rays of energies 1.17 and 1.33 Mev; an attempt has been made to explain the formation of the peaks in the distribution curves in the light of the different processes through which γ rays lose energy in the crystal material; the positions of the peaks agree well with the positions expected from theoretical considerations. The results have been discussed with mentions of the reports of different workers in this line. The electronic circuits and the experimental arrangements designed for the present purpose are described in detail. (auth)

1643

A PROPORTIONAL-COUNTER TECHNIQUE FOR MEASURING X-RAY SCATTERING FROM POWDERS, FIBRES AND LIQUIDS. U. W. Arndt, W. A. Coates, and D. P. Riley (The Royal Institution, London, England). Proc. Phys. Soc. (London) B66, 1009-16(1953) Dec.

Counter spectrometers are described for the accurate semi-automatic measurement of diffracted x-ray intensity over a range of scattering angles from 0 to 130°. A proportional counter is used in conjunction with a linear amplifier and a single-channel pulse analyzer. The degree of monochromatization attained with a Cu target and Ni filter is such that 99% of the measured intensity is due to Cu $K\alpha$ radiation. The various corrections to be applied are discussed. (auth)

1644

THE DESIGN AND OPERATION OF A DOUBLE MAGNETIC LENS BETA-RAY SPECTROMETER. G. P. Rundle, J. Ellis, T. C. Griffith and H. S. Tomlinson (University Coll., London, England). Proc. Phys. Soc. (London) B67, 52-64 (1954) Jan.

Details are given of the design of a double magnetic-lens spectrometer. Both coils of this spectrometer are capable of very fine adjustment in five degrees of freedom. Extensive work has been carried out on the testing of this instrument. This has included a study of the variation of spherical aberration with coil separation, the use of a quick and accurate experimental method of plotting trajectories, and an investigation of the extremely critical nature of coil alignment. Experimental confirmation of the predictions of Deutsch and his co-workers has also been obtained, and ring focus has been incorporated with notable success. This spectrometer has a much lower spherical aberration than a short lens and gives a performance comparing not unfavorably with long-lens types. (auth)

1645

AN IMPROVEMENT IN HIGH SPEED EXPANSION OF COUNTER-CONTROLLED CLOUD CHAMBER. Isao Kita (Kobe Univ., Japan). J. Phys. Soc. Japan 8, 803-4(1953) Nov.-Dec.

A simple electronic circuit is suggested for decreasing the magnetic field decay time of an electromagnetic expansion valve for a Wilson cloud chamber. (K.S.)

1646

ELECTRIC RECORDER FOR THE GAMMAGRAPH. Martin E. Jacobs, Alan L. Orvis, and Bernice B. Borrman (Mayo Clinic, Rochester, Minn.). Nucleonics 12, No. 1, 60-1(1954). Jan.

An electric recorder is described which, when used with the gammagraph eliminates recorder noise and produces traces of uniform quality. A single unit consists essentially of a thyratron switch tube, a capacitor, a stylus electrode, and the associated power supply. A schematic sketch of the recorder circuit, and a typical gammagraph of I^{131} activity in a thyroid phantom are included. (C.H.)

1647

ELECTRON MICROSCOPICAL STUDIES OF THE LATENT IMAGE OBTAINED BY EXPOSURES TO ALPHA PARTICLES, X-RAYS, AND LIGHT. H. Hoerlin (General Aniline and Film Corp., Binghamton, N. Y.) and F. A. Hamm (General Aniline and Film Corp., Easton, Penna.). J. Appl. Phys. 24, 1514-19(1953) Dec.

The latent image of ordinary photographic emulsions has not been resolved. However, the slightly enlarged latent image as obtained by physical Au development can be demonstrated by means of the electron microscope. For the case of a fast negative emulsion it is shown that different types of exposures result in latent-image centers of significantly different size distribution characteristics. High-intensity α-particle and x-ray exposures produce a very large number of finely dispersed centers; irradiation with light of optimum intensity and 1/100 sec duration forms a small number of centers; only very few specks result from exposures to light of very low intensity. The patterns observed are in line with expectations based on current photographic theory. (auth)

1648

A NOTE ON THE RANGE-SCATTERING METHOD OF MASS ESTIMATION OF IONIZING PARTICLES. M. G. K. Menon and C. O'Ceallaigh (Univ. of Bristol, England). Phil. Mag. (7)44, 1291-6(1953) Nov.

The applicability of the method of Menon and Rochat to the estimation of the mass of singly ionizing particles arrested in photographic emulsion is examined, and modifications necessary to take account of (a) dip and (b) the variation of scattering constant with cell size and velocity are discussed. The 'sliding cut-off' method of eliminating large unrepresentative signals is described in detail. (auth)

1649

GAMMA-RAY SCINTILLATION COUNTER FOR WEAK RADIOACTIVE SOLUTIONS. C. P. Haigh (Barrow Hospital, Barrow Gurney, Bristol, England). Nucleonics 12, No. 1, 34-9(1954) Jan.

A scintillation counter is described which is adapted to take liquid samples of up to 10 ml, and gives good results when measuring radioactive samples of very low activity. A practical limit of 10^{-11} c/ml was obtained with I^{131} and Fe^{59}. Performance is compared with that of a jacketed β counter for measuring solutions of I^{131}. (C.H.)

1650

RESOLVING POWER OF THE SOLENOIDAL BETA-RAY SPECTROMETER. OPTIMUM DESIGN CONSIDERATIONS. J. Mahanty, S. Pandit, and C. Balakrishnan (National Physical Lab. of India, New Delhi). J. Sci. Ind. Research (India) 12B, 571-83(1953) Dec.

The causes for the spread of the spectral line arising from inherent instrumental factors of solenoidal β-ray spectrometers are rigorously examined on the basis of existing theories, and expressions are obtained for the base width and the intensity distribution of the component line profiles. Necessary conditions are enumerated for compounding the components to produce a resultant with minimum width at half-maximum intensity. A general expression is derived for calculating the position of the entrance slit for various slopes of the locus of the foci for β particles of different energies. Expressions are given for the critical position and the minimum radius of the counter window. The optimum emission angles for minimum half width and maximum intensity are shown to be 45° 37′ 42.1″ for a point-source spectrometer and 40° 21′ 42.4″ for one with a

disk source. The corresponding values for spreads are calculated in terms of the gathering power and luminosity, respectively. Data, based on this theory of the characteristics of two spectrometers designed in the laboratory are included. The effect of the eccentric location of the entrance slit for points which lie on the disc source displaced from the axis on the optimum source radius and the spread is treated. The base width of the resultant line profile is shown to be the sum of the base widths of its components. (auth)

1651

SCINTILLATIONS IN CsI AND γ SPECTROMETRY. B. Hahn and J. Rossel (Univ. of Neuchâtel, Switzerland). Helv. Phys. Acta 26, 803-10(1953) Dec. (In French)

The study of γ scintillations in a cooled CsI crystal (without activator) gives the following results: The pulse height at 100°K is nearly twice the one occurring in NaI(Tl) with the same optical geometry; furthermore the Po α particles produce, per Mev, only 85% of the light effect of the γ rays. Other differences between α and γ excitations are presented. The crystal has a proportional response for γ energy between 40 kev and 1.3 Mev. As a measure of the resolution of a scintillation spectrometer with CsI crystal, the figure of 11% was obtained for the total width at half maximum of the photopeak of Ce^{141} γ rays (145 kev). This small width as well as a comparison with α scintillations indicate an absolute luminescence efficiency of about 40% for CsI. (auth)

1652

DEVELOPMENT OF A PROTON SCINTILLATION SPECTROMETER. F. P. G. Valckx and P. M. Endt. Physica 19, 1140-2(1953) Nov. (In English)

A description is given of a crystal mounting which obviates the necessity of flushing the target chamber with dry N_2 when the target is changed. The NaI crystal is mounted on the bottom of a small glass cuvette, which is closed with a brass cap containing a thin (15-μ) Al foil window. An example of the resolution obtained is given by a pulse analysis of the protons from the $B^{10}(d,p)B^{11}$ reaction. (J.S.R.)

MESONS

1653

THE RELATIVE PRIMARY AND TOTAL IONIZATION OF μ-MESONS AS A FUNCTION OF ENERGY. G. P. Yeliseyev, V. K. Kosmachevsky, and V. A. Lyubimov. Translated from Doklady Akad. Nauk S.S.S.R. 90, 995-8(1953). 4p. (NSF-tr-163)

The spectra of primary and total ionization of μ mesons are theoretically obtained by two completely general methods. (K.S.)

1654

CHARGED PARTICLES OF MASS INTERMEDIATE BETWEEN PROTON AND DEUTERON. D. T. King, Nathan Seeman, and Maurice M. Shapiro (Naval Research Lab., Washington, D. C.). Phys. Rev. 92, 838-9(1953) Nov. 1.

Two cloud-chamber observations of singly charged unstable particles with mass greater than a proton are analyzed. One example consisted of a fast product of a nucleon-nucleon collision; the other came to rest with the probable emission of a light meson. The masses were found to be $2560 \pm 500\ m_e$ for the fast particle and $2860 \pm 850\ m_e$ for the stopped event. Evidence from an analysis of the tracks, as well as information reported elsewhere, supports a $Y^{\pm} \rightarrow V_1^0 + \pi^{\pm}$ decay scheme. (K.S.)

1655

ISOTOPIC SPIN AND NEW UNSTABLE PARTICLES. M. Gell-Mann (Univ. of Chicago, Ill.). Phys. Rev. 92, 833-4 (1953) Nov. 1.

The instability of such particles as the V_1, V_4, and τ mesons was investigated by their electromagnetic interactions and interactions involving charge dependence and the conservation of isotopic spin. Peaslee (Phys. Rev. 86, 127 (1952)) has pointed out that consideration of the electromagnetic interaction leads to a transition in the V_1^0 particle which occurs sooner than the observed lifetime of $\sim 3 \times 10^{-10}$ sec. In connection with these factors, it is suggested that these particles be considered fermions with integral isotopic spin and bosons with half-integral isotopic spin. The consequences of this theory are discussed. (K.S.)

1656

EXCITATION OF NUCLEI BY ABSORPTION OF π^- MESONS. II. RESULTS AND CONCLUSIONS. V. De Sabbata, E. Manaresi, and G. Puppi (Univ. of Balogna, Italy). Nuovo cimento 10, 1704-28 (1953) Dec. 1. (In Italian) (cf. NSA 6-5852)

This paper closes a work about the absorption of π^- mesons bound on the K-orbit by middle-weight nuclei (A = 100). The problem is treated by the Monte Carlo method, and results are compared with experience. The distribution of stars against the number of visible prongs, the percentage of fast protons (E > 30 Mev), the emission ratio of α particles to protons, and the percentage of captures without visible prongs agree with experimental data if we suppose that the primary act of absorption in matter is performed by a proton-neutron pair. Remembering the results of the capture by nuclei of π mesons in nuclear matter at all energies (at least up to 100 Mev) is essentially due to a proton-neutron pair. (auth)

1657

INTERACTION OF π^+ MESONS IN PHOTOGRAPHIC PLATES (I). A. Minguzzi, G. Puppi, and A. Ranzi (Univ. of Bologna, Italy). Nuovo cimento 10, 1753-5 (1953) Dec. 1. (In English)

A systematic survey of photographic plates exposed to 62 Mev π^+ mesons revealed two peculiar events. Twenty-two examples of the scattering of π^+ mesons on H were identified, and it was noted that the angular distribution was strongly peaked backward. A cross section of 22 ± 5 mb was calculated for a mean energy of 65 Mev. Six stops of π^+ mesons were observed. The elementary cross section per neutron was estimated to be 5 mb. (J.S.R.)

1658

NON-LOCAL FIELDS AND COMPLEX NATURE OF "ELEMENTARY" PARTICLES (DYNAMIC DEFORMATION FORM FACTOR). M. A. Markov. Uspekhi Fiz. Nauk 51, 317-41(1953) Nov. (In Russian)

A review is given of the present work concerning the fields and complex nature of mesons. The attempts to analyze the elementary particles by expansion within the frame of the Hamiltonian or S-matrix methods are described. The dynamic deformation form factor and its applicability to analyzing the origin of mesons is discussed. (J.S.R.)

1659

THE AUGER EFFECT AND NEGATIVE MESON CAPTURE. A. H. de Borde (University Coll., London, England). Proc. Phys. Soc. (London) A67, 57-67(1954) Jan.

Previous work on the mesonic Auger effect is extended to meson capture in noncircular orbits and to Auger emission of L-shell electrons. Corrections to the theoretical results are discussed, and calculations made of the probable Auger emission from heavy elements for capture in photographic emulsions. The results are compared with observations, and reasons suggested for a deviation. (auth)

1660

AN UNUSUAL STAR. S. Nakagawa, H. Huzita, and K.

Okudaira (Rikkyo Univ., Tokyo, Japan). J. Phys. Soc. Japan 8, 801-2(1953) Nov.-Dec.

A star-producing nuclear event in an Ilford G5 400-μ emulsion is analyzed. The large scattering of the tracks and the decrease in density with distance preclude the possibility of a proton reaction, and it is concluded that the event is an example of a heavy meson interaction with an emulsion nucleus. (K.S.)

1661

CAPTURE OF μ^- MESONS BY DEUTERONS. A. Rudik. Doklady Akad. Nauk S.S.S.R. 92, 739-42(1953). Oct. 1. (In Russian)

The three reactions $\mu^- + p \rightarrow n + \nu$, $\mu^- + D \rightarrow n + n + \nu$, and $\mu^- + He^3 \rightarrow He^3 + \nu$ are analyzed for scalar, vector, tensor, axial vector, and pseudoscalar variants of interaction. The work functions for the D and He^3 reactions are derived, and their ratios calculated. For axial scalar, tensor, and pseudoscalar variants $W_D/W_{He^3} \sim 0.11$, and for scalar and vector variants $W_D/W_{He^3} \sim 0.045$. (J.S.R.)

1662

OBSERVATION OF THE STOPPING OF HEAVY MESONS. A. Alikhanyan, V. Kirillov-Ugryumov, N. Shostakovich, V. Fedorov, and G. Merzon. Doklady Akad. Nauk S.S.S.R. 92, 915-17(1953). Oct. 11. (In Russian)

Three photographs of the stopping of heavy mesons in a Wilson cloud chamber are discussed. In the first photograph, the particle, from impulse and range measurements, had a mass of 990 m_e; in the second photograph, the mass of the particle was 940 ± 90 m_e; and in the third, the mass was 1520 ± 150 m_e. (J.S.R.)

1663

THE SELECTION OF "NON-PERTURBATION" OPERATORS OF ENERGY IN THE THEORY OF THE INTERACTION OF NUCLEONS WITH THE FIELD OF PSEUDOSCALAR MESONS. Yu. V. Novozhilov. Doklady Akad. Nauk S.S.S.R. 92, 931-3(1953). Oct. 11. (In Russian)

Usually the perturbation theory in its common form is inapplicable for the pseudoscalar interaction of nucleons with the field of pseudoscalar π mesons. However, nonrelativistic approximations were carried out for the case of pseudoscalar bonds. (J.S.R.)

1664

THE DECAY-IN-FLIGHT OF A HEAVILY IONIZING τ-MESON. D. B. Gayther (Univ. of Manchester, England). Phil. Mag. (7) 44, 1297-9(1953) Nov.

A τ meson has been observed to decay in the gas of a cloud chamber operated without a magnetic field. The τ meson was apparently created directly in an energetic nuclear interaction. Its energy at creation was about 100 Mev, and it lived for a proper time of $(7.8 \pm 1.0) \times 10^{-10}$ sec in the illuminated volume of the chamber. (auth)

1665

"NONMESONIC" BOUND V-PARTICLE DECAY. W. Cheston and H. Primakoff (Washington Univ., St. Louis, Mo.). Phys. Rev. 92, 1537-41(1953) Dec. 15.

A theoretical treatment is presented of the apparent relative stability of V particles in nuclear matter in terms of the process of bound V-particle nonmesonic decay. Mean lives for nonmesonic decay of V particles imbedded in nuclear fragments such as He, Li, ... O, are estimated as $\approx 10^{-11}$ to 10^{-12} sec. A very brief discussion is given of the bearing of such relatively long mean lives on possible mechanisms of V-particle production. (auth)

METEOROLOGY

*1666

Hanford Works

A PORTABLE METEOROLOGICAL MAST. P. W. Nickola and R. G. Clark. Sept. 30, 1953. 29p. Contract W-31-109-Eng-52. (HW-29478)

A portable meteorological mast is described. This mast is used in micrometeorological studies in the lowest 42 ft of the atmosphere, including the distribution of airborne particulate matter and its relationship to some meteorological parameters. Thermocouples, wind vanes, anemometers, and particle samplers are distributed vertically on this mast in order to investigate the distribution of temperature, wind, and particulate matter with height. A soil heat flow meter is buried at some desired depth near the mast for use in assigning the role of soil heat transfer in the micrometeorology of the lower atmosphere. The mast and associated equipment are a self-contained unit and as such may be set up and operated in relatively remote areas. A portable generator is used for power. (auth)

MICROWAVES

1667

Atomic Energy Research Establishment, Harwell, Berks (England)

A CONTRIBUTION TO THE THEORY OF THE ROD-LOADED WAVE GUIDE. J. D. Pearson. Oct. 1953. 24p. (AERE-T/M-90)

The rod-loaded guide is studied at cut-off, i.e., when the width of the guide is λ/2. Expressions for the power loss and shunt impedance are obtained for rods of rectangular and circular cross section in the π mode. An expression for Q for circular rods is also given. (auth)

MOLECULAR PROPERTIES

1668

Los Alamos Scientific Lab.

ON THE THEORY OF LIQUID He_3-He_4 MIXTURES. Louis Goldstein. [1953]. 43p. Contract W-7405-eng-36. (AECU-2774)

The asymptotic model of liquid He^3-He^4 mixtures has been investigated whereby the components are represented as ideal antisymmetric and symmetric fluids, respectively, whose atoms are constrained to move in a smoothed constant-potential energy well. Complete miscibility is indicated at all temperatures. The isothermal energy of mixing is positive at low temperatures provided that the degeneracy of the antisymmetric component is small. The phase transition exhibited by the symmetric component is perturbed. While it is a smooth first-order phase change in the absence of He^3, it becomes a third-order one in the presence of He^3. The constant-pressure and constant-volume heat capacities of the mixtures have sharp peaks along the transition line; their temperature derivatives have λ points along this line. The transition line is thus associated with a well defined third-order phase change, with the exception of its two limiting points. The one with vanishing He^3 concentration corresponds to a first-order phase change, whereas the other, with vanishing He^4 concentration, is not associated with any transition of finite order. (auth)

NUCLEAR PHYSICS

1669

Radiation Lab., Univ. of Calif., Berkeley

EFFECT OF NEGATIVE ENERGY COMPONENTS IN THE TWO-NUCLEON SYSTEM. R. Arnowitt and S. Gasiorowicz. Dec. 1953. 27p. Contract W-7405-eng-48. (UCRL-2402)

A feature of the Levy-Klein solution of the Bethe-Salpeter equation for the deuteron is the elimination of ϕ_{+-}, ϕ_{-+}, and ϕ_{--} in terms of the ϕ_{++} component of the wave function via a perturbation expansion. To investigate the validity of this procedure, the coupled equations for the various components in the first nonadiabatic approximation to the Δ_+ interaction

were examined. A set of first-order radial equations with multiplicative potentials (in the region $r > 1/m$) was obtained, involving $\phi_{\pm\pm}(r) = \frac{1}{4}(1 \pm \beta_1)(1 \pm \beta_2)\phi(r)$. A rigorous elimination of ϕ_{+-} and ϕ_{-+} led to equations containing ϕ_{++} and ϕ_{--}. In addition to velocity-dependent terms, potentials of the type

$$\frac{\mu^2}{2m}\frac{g^2}{4\pi}\tau_1\cdot\tau_2\frac{Y(r)}{P_0 + \frac{1}{2}\frac{g^2}{4\pi}\tau_1\cdot\tau_2\,Y(r)}$$

appear. Expansion of the denominator yields the usual Yukawa second-order potential plus a term proportional to $g^4(\tau_1\cdot\tau_2)^2$. Such an expansion, however, is poor even for $r \sim 1/\mu$, a pole actually existing near $r \sim 0.7/\mu$ for the singlet charge state. Thus the perturbation expansion appears to radically alter the structure of the equations. (auth)

1670

ON THE THEORY OF PAIR PRODUCTION DURING A COLLISION OF HEAVY PARTICLES. L. B. Okun. Translated from Doklady Akad. Nauk S.S.S.R. 89, 833-5(1953). 3p. (NSF-tr-127)

An abstract of this paper appears in Nuclear Science Abstracts as NSA 7-5839.

1671

ISOTOPIC SPIN AND COULOMB FORCES. II. EXCITED STATES OF LIGHT NUCLEI. L. A. Radicati (Univ. of Birmingham, England). Proc. Phys. Soc. (London) A67, 39-43(1954) Jan. (cf. NSA 7-2386.)

The isotopic-spin purity of some low-lying excited states in light nuclei is calculated in first-order perturbation theory. Special attention is given to the odd-parity states in even nuclei. The isotopic-spin impurity caused by coulomb forces is shown to be sufficient to account for the electric dipole transition in O^{16} between the 7.12 Mev excited state and the ground state. (auth)

NUCLEAR PROPERTIES

1672

Los Alamos Scientific Lab.

THERMAL NEUTRON CAPTURE CROSS SECTIONS OF $_1H^1$ AND BORON. F. R. Scott, D. B. Thomson, and W. Wright. [1953]. 6p. Contract W-7405-eng-36. (AECU-2759)

The thermal neutron capture sections of H and B were measured as $\sigma_H = 0.320 \pm 0.006$ and $\sigma_B = 709 \pm 17$ barns. The pulsed neutron source was obtained from the (γ,n) and (γ,f) reactions in U using a betatron. The measurements were made in a finite variable geometry using a modification of the sigma pile method. (J.S.R.)

1673

ON THE INTERACTION CROSS SECTION OF VERY FAST NUCLEONS. E. [Ye.] L. Feinberg and D. S. Chernavskii [Chernavsky]. Translated from Doklady Akad. Nauk S.S.S.R. 91, 511-13(1953). 3p. (NSF-tr-111)

By taking into account the quantum structure of the meson field of the nucleons, results for large impact parameters indicate that the interaction cross section does not increase with energy as strongly but remains of the same order of magnitude as the geometrical cross section. The nature of each elementary event will be that of an interaction of a nucleon with one meson. (auth)

1674

DETERMINING 0 AND $\hbar/2$ SPINS OF NUCLEI FROM MICROWAVE SPECTRA OF MOLECULES. A. M. Prokhorov and N. G. Basov. Translated from Doklady Akad. Nauk S.S.S.R. 90, 1003-4(1953). 2p. (NSF-tr-169)

An abstract of this paper appears in Nuclear Science Abstracts as NSA 7-5618.

1675

THE MOMENTS OF INERTIA OF LIGHT NUCLEI. Félix Joachim Wiśniewski. Compt. rend. 237, 1222-4(1953) Nov. 16. (In French)

Having established that the energy levels of He, Li, Be, B, C, and N are rotation levels (NSA 6-6148 and 7-3883), the author calculates their moments of inertia and their relation to the nuclear mass. The values are tabulated, and a tentative interpretation of the results is given. (J.S.R.)

1676

HYPERFINE STRUCTURE IN THE IRIDIUM I-SPECTRUM AND THE NUCLEAR MOMENT OF THE STABLE IRIDIUM ISOTOPE. Winrich v. Siemens (Univ. of Göttingen, Germany). Ann. Physik 13, 136-57(1953). (In German)

In a Schüler cavity cathode, cooled with liquid air, the Ir spectrum was excited, and the hfs investigated with a Fabry-Perot interferometer in the spectral region 3900 to 6300 A. Forty lines in which a cleavage was found were measured on the comparator, and in 30 lines the intensity distribution was recorded spectrographically. From the line structure the nuclear angular momentum quantum number of Ir^{193} (by counting the components) and of Ir^{191} (by intensity measurements) was determined to be $I = \frac{3}{2}$. The ratios of the magnetic moment and nuclear quadrupole moment of both isotopes were $\mu_{193}/\mu_{191} = 1.0 \pm 0.1$ and $Q_{193}/Q_{191} = 1.0 \pm 0.3$, respectively. From the cleavage factor it was estimated that $\mu_{193} = 0.2 \pm 0.1$ nm and $Q_{193} = 1.5 \pm 1 \times 10^{-24}$ cm^2. A thorough investigation of the isotopic displacement in the Ir I-spectrum led to a new determination of the electron configuration for some terms and to an estimation of the isotopic displacement constant as $\beta C_{exp} = 130 \pm 30 \times 10^{-3}$/cm. (tr-auth)

1677

INTERMEDIATE COUPLING AND NUCLEAR REACTIONS. A. M. Lane (Birmingham Univ., England). Phys. Rev. 92, 839(1953) Nov. 1.

Expressions for the reduced widths of energy levels for nucleon emission and electromagnetic matrix elements are theoretically developed for L-S and j-j coupling modes in the shell model of nuclei. It is found that neither extreme mode satisfactorily fits known data for light nuclei and that an intermediate coupling scheme would be more satisfactory. These conclusions are tested by application to C^{13} and N^{13}, and the results are shown to be consistent with an intermediate coupling model. (K.S.)

1678

UPON THE CALCULATION OF THE DIFFUSION OF BODIES OF SPIN $\hbar/2$ BY A RADIAL PSEUDOSCALAR POTENTIAL. Gérard Petiau (Inst. Henri Poincaré, France). J. phys. radium 14, 648-56(1953) Dec. (In French)

The diffusion wave corresponding to a plane incident wave representing a beam of bodies with spin $\hbar/2$ is calculated for the case of a constant pseudoscalar interaction in a sphere of radius R and for the case when the pseudoscalar interaction has the form $\beta\,\hbar/r$. (tr-auth)

1679

THE QUADRUPOLE MOMENT OF THE GOLD NUCLEUS Au^{197}. Winrich v. Siemens (Univ. of Göttingen, Germany). Ann. Physik 13, 158-64(1953). (In German)

The hfs of 3 lines of the Au spectrum was investigated with a Fabry-Perot interferometer. The cleavage factor of the term $5d^96s^2\ ^2D_{3/2}$ was determined, from which the nuclear quadrupole moment was calculated as $Q = 0.56 \pm 0.1 \times 10^{-24}$ cm^2. The magnetic nuclear moment was $\mu_I = 0.14 \pm 0.02$ mm, in agreement with the value calculated by Kelly. (tr-auth)

1680

ISOTOPIC SPIN SELECTION RULES. III. RADIATIONS FROM ^{14}N. A. B. Clegg and D. H. Wilkinson (Cavendish

Lab., Cambridge, England). Phil. Mag. (7) 44, 1269-75 (1953) Nov.

It is pointed out that the 8.06-Mev (1−) state of N^{14} is of T = 1, corresponding to the 6.10-Mev state of C^{14}. The electric dipole transition to the 2.31 (0+) T = 1 state of N^{14} is therefore forbidden by the isotopic spin selection rules. It is shown that the strength of this forbidden electric dipole transition is less than 0.7% of that of the allowed electric dipole transition to the (1+) T = 0 ground state of N^{14}; this implies that the contamination of the 8.06-Mev state by a state of T = 0 is less than 2% in intensity. (auth)

1681

MEASUREMENT OF ENERGY LEVELS OF THE NUCLEI CARBON, OXYGEN, AND MAGNESIUM BY THE METHOD OF MAGNETIC ANALYSIS. L. M. Khromchenko. Doklady Akad. Nauk S.S.S.R. 93, 451-4(1953) Nov. 21. (In Russian)

The photomicrographic energy spectra of C, O_2, and Mg exicted by deuterons and protons are given. The energy levels of C^{13}, O^{17}, and Mg^{25} calculated from the spectra are tabulated. (J.S.R.)

1682

INVESTIGATION OF THE NUCLEAR ISOMERS OF Zn^{69}, Nb^{95}, AND Ba^{137}. B. M. Dolishnyuk, G. M. Drabkin, V. I. Orlov, and L. I. Rusinov. Doklady Akad. Nauk S.S.S.R. 92, 1141-4(1953) Oct. 11. (In Russian)

The energy spectrum of the β transition of Zn^{69} to Ga^{69} is given. The maximum energy was 920 ± 20 kev, and two maxima occurred on the curve at 429 ± 3 and 437 ± 3 kev. The 437 ± 3-kev maximum arose from the metastable state of Zn^{69}. The electron spectra of Nb^{95} and of Ba^{137} are also given. Two maxima of 201 ± 2 and 217 ± 2 kev were observed in Nb^{95}, corresponding to the K and L conversion to Nb^{95*}. In the Ba^{137} spectrum three maxima were observed at 624 ± 2, 655 ± 2, and 660 ± 2 kev, corresponding to the K, L, and M conversion to Ba^{137*}. The states of the nuclei were determined to be: Zn^{69}, $p_{1/2}$; Zn^{69*}, $g_{9/2}$; Nb^{95}, $g_{9/2}$; Nb^{95*}, $p_{1/2}$; Ba^{137}, $p_{3/2}$; and Ba^{137*}, $h_{11/2}$. (J.S.R.)

1683

OBSERVATIONS ON A NEUTRON-RICH RHENIUM ISOTOPE. A. H. W. Aten, Jr., and G. D. De Feyfer (Instituut voor Kernphysisch Onderzoek, Amsterdam, Holland). Physica 19, 1143-4(1953) Nov. (In English)

Short-lived Re isotopes were formed from Os by the (n,p) reaction. After precipitation of the Re fraction, a β^- period of $9^3/_4 \pm {}^1/_2$ min and a very weak activity with half life of 1 or 2 hr were observed. Absorption measurements in Al indicate a maximum energy of 1.8 ± 0.2 Mev for the $9^3/_4$-min isotope. This isotope probably has a mass number of 189, 190, or 192. (J.S.R.)

1684

DATA ON LEVEL SHIFTS. Willis E. Lamb, Jr. (Stanford Univ., Calif.). Physica 19, 832(1953) Sept. (In English)

The observed and calculated values of level shifts in H, D, ionized He, and positronium are tabulated. A value $1/a = 137.0365 \pm 0.0012$ is calculated for the fine structure constant a. The discrepancies are possibly due to errors in the elaborate calculations, contributions of higher-order perturbation terms not yet calculated, or an additional non-electromagnetic interaction between electrons and protons. (J.S.R.)

1685

THE MEASUREMENT OF NUCLEAR MOMENTS OF EXCITED STATES BY ANGULAR CORRELATION METHODS. I. Kurt Alder (Univ. of Copenhagen, Denmark), H. Albers-Schönberg, Ernst Heer, and T. B. Novey (Swiss Federal Inst. of Tech., Zürich, Switzerland). Helv. Phys. Acta 26, 761-84(1953) Dec. (In English)

It is shown that angular correlation measurements are well suited for the determination of the magnetic moment and the electric quadrupole coupling in short-lived excited states. Formulas and graphs are given for various experimental arrangements and spin values between 1 and $^1/_2$. The influence of finite resolving time and delayed coincidence measurements is discussed. Sample calculations are made for the well known case of Cd^{111}. (auth)

1686

THE HYPERFINE STRUCTURE ANOMALY OF SILVER. E. Brun and H. H. Staub (Universität Zürich, Switzerland). Helv. Phys. Acta 26, 821-7(1953) Dec. (In German)

The recent very accurate measurements of the hyperfine structure splitting and the nuclear magnetic moments of the two stable silver isotopes Ag^{107} and Ag^{109} give a value of the hfs anomaly of 0.413%. Calculations of this anomaly are made on the basis of various nuclear models. It is found that the two single particle models of Bloch, de Shalit, and Miyazawa and of Davidson lead to the best agreement, viz 0.41 and 0.44%, respectively. (auth)

1687

NUCLEAR REACTION DETERMINATION OF THE Sn^{124}—Te^{124} MASS DIFFERENCE. N. S. Wall (Mass. Inst. of Tech., Cambridge). Phys. Rev. 92, 1526(1953) Dec. 15.

The Q values for the ground state (d,p) reactions on Sn^{124} and Te^{124} have been measured and found to be 3.52 ± 0.07 and 4.25 ± 0.07 Mev, respectively. From these data and the decay energies of Sn^{125} and Sb^{125} the mass difference of Sn^{124} — Te^{124} is found to be 2.4 ± 0.1 Mev. (auth)

1688

SPIN-ORBIT COUPLING ENERGY IN O^{17}. Robert K. Adair. (Univ. of Wisconsin, Madison). Phys. Rev. 92, 1491-3(1953) Dec. 15.

A proportional counter filled with CO_2 was irradiated with monoenergetic fast neutrons produced by bombarding thin Li targets with protons from an electrostatic generator. Angular distributions of neutrons scattered by O were deduced from the energy spectrum of recoil O ions for neutron energies from 392 to 1412 kev, determining the parities of three spin-$^3/_2$ levels in O^{17}, 4.56, 5.08, and 5.39 Mev above the ground state. The 5.08-Mev state has even parity and appears to be the $D_{3/2}$ member of a $D_{3/2}$—$D_{5/2}$ doublet, where the $D_{5/2}$ level is then 5 Mev higher than the $D_{5/2}$ ground state of O^{17}. The other two states have odd parity and lie more than 1.5 Mev above the lowest spin-$^1/_2$ odd-parity level. This may indicate a spin-orbit splitting of the order of 2 Mev or greater in the P shell. (auth)

NUCLEAR REACTORS

1689

Atomic Energy Research Establishment, Harwell, Berks (England)

SHIELDING STUDIES. 2. THE DISTRIBUTION OF GAMMA-RADIATION IN GRAPHITE MODERATED URANIUM REACTORS. C. C. Horton. Oct. 14, 1953. 27p. (AERE-R/R-1271)

The distribution of γ radiation in the core, reflector, thermal column, and a mock thermal shield of BEPO has been studied using a homogeneous ion chamber. The chamber is of simple construction, and its output current is a known function of the γ energy deposited in the chamber volume. The results may be fitted by formulas based on a simple method of calculation of γ transmission through matter. It is shown that the radiation escaping from a typical graphite-U reactor consists mainly of γ rays from neutron capture in the moderator and thermal shield; these have an effective energy of about 5 Mev. The γ radiation in the core of such a reactor is shown to consist mainly of soft γ rays originating in the fission process and from decay of the fission products. From these results the distribution of γ rays in the shield of BEPO has been

calculated and shown to fit data obtained by other experiments over the range of measurements. (For Part 1 in this series see AERE-R/R-842.) (auth)

*1690

NEPA Div. Fairchild Engine and Airplane Corp.
CALIBRATING OF THE NEPA STANDARD PILE. Fred Maienschein and William B. Baker. June 16, 1950. 31p. [Contract W-33-08-ac-14801 (16250)]. (NEPA-1446)

1691

KINETIC BEHAVIOR OF A THERMAL HEAVY-WATER REACTOR. A. Lundby and N. Holt (Joint Establishment for Nuclear Energy Research, Kjeller, Norway). Nucleonics 12, No. 1, 22-5(1954) Jan.

A fast-detection technique is described which was used to study power-level variations following a sudden change in reactivity of the JEEP reactor. Comparison with theory yielded a value for the average neutron lifetime in the reactor of 2×10^{-3} sec. (C.H.)

1692

PLANS FOR THE NEW ARGONNE RESEARCH REACTOR, CP-5. S. Untermyer (Argonne National Lab., Lemont, Ill.). Nucleonics 12, No. 1, 12-15(1954) Jan.

Design features of a new research reactor, the CP-5, nearing completion at Argonne National Lab. are described and illustrated diagrammatically. The reactor uses enriched-U fuel and heavy water as coolant-moderator. The design has a large experimental volume, yields high flux at low power, and its long neutron lifetime and strong photoneutron background insure safe operation. (C.H.)

1693

REACTOR DESIGNS FOR COMMERCIAL POWER. J. R. Menke (Nuclear Development Associates, Inc. White Plains, New York). Nucleonics 12, No. 1, 66-8(1954) Jan.

Reactors which may possibly be used to produce commercial power are rated as to neutron economy, processing, capital cost, revenue, safety, and construction difficulty. Reactor types considered include graphite-moderated, heavy-water-moderated, light-water-moderated, homogeneous, and fast reactors of the experimental breeder type. (C.H.)

1694

DISCONTINUOUS SERVO FOR CONTROL OF POWER REACTORS. J. M. Harrer and J. A. Deshong, Jr. (Argonne National Lab., Lemont, Ill.). Nucleonics 12, No. 1, 44-51 (1954) Jan.

A discontinuous servo for reactor control is described which is simple, compact, and economical from both the initial cost and maintenance standpoints. The system has been operated successfully on the Argonne Heavy Water Reactor, CP-3, and while this experience is not directly applicable to a power reactor, it is felt that the system may be used successfully on such a reactor. Design principles and procedures are discussed, and performance data are presented. (C.H.)

NUCLEAR TRANSFORMATION

1695

Los Alamos Scientific Lab.
ANGULAR DISTRIBUTION OF FRAGMENTS FROM NEUTRON-INDUCED FISSION. J. E. Brolley, Jr. and W. C. Dickinson. [1953] Decl. with deletions Dec. 7, 1953. 9p. Contract W-7405-eng-36. (AECD-3609)

A parallel-plate ionization chamber, in which one electrode served as a collimator, was employed to study the angular distribution of fission fragments referred to the neutron-beam axis. Fragments from neutron bombardment of the following nuclei were examined: Th^{232}, U^{233}, U^{235}, U^{238}, and Np^{237}. When 14-Mev neutrons were used, a preponderance of fission along the neutron axis as compared with the orthogonal direction was noted. The average value obtained for the 0°/90° ratios was 1.26. Thermal neutron fission was found to be isotropic. (auth)

1696

Livermore Research Lab., Calif. Research and Development Co.
CROSS SECTIONS FOR FORMATION OF Be^7 FROM BERYLLIUM BOMBARDED WITH HELIUM IONS, DEUTERONS, AND PROTONS. R. E. Batzel and G. H. Coleman. Dec. 1953. 17p. Contract AT(11-1)-74. (LRL-72)

The cross section for the formation of Be^7 from Be^9 bombarded with He ions, deuterons, and protons has been measured as a function of particle energy from threshold to 380, 190, and 340 Mev, respectively. The cross section for all of these nuclear reactions rises sharply from threshold to a peak at approximately 90 Mev and remains relatively constant to the maximum energy of the particles used. (auth)

1697

Radiation Lab., Univ. of Calif., Berkeley
FURTHER PRODUCTION OF TRANSCURIUM NUCLIDES BY NEUTRON IRRADIATION. Bernard G. Harvey, Stanley G. Thompson, Albert Ghiorso, and Gregory R. Choppin. Jan. 11, 1954. 3p. Contract W-7405-eng-48. (UCRL-2456)

Alpha particles of about 7.2 Mev and 3-hr half life have been found in MTR-irradiated Cf isotopes and are attributed to element 100. A tentative isotope assignment of 100^{254} has been made. A probable reaction sequence for production of this isotope is $Cf^{252}(n,\gamma)Cf^{253} \xrightarrow{\beta^-} 99^{253}(n,\gamma)99^{254} \xrightarrow{\beta^-} 100^{254}$. (K.S.)

1698

UPON THE REACTIONS (d,p) AND (d,n). J. Horowitz and A. M. L. Messiah (Centre d' Études nucléaires, Saclay, France). J. phys. radium 14, 695-706(1953) Dec. (In French)

In a study of the reactions (d,p) and (d,n) or rather of the equivalent reactions (p,d) and (n,d), the conditions of validity of Butler's approximation were studied. The equivalence of the Butler approximation with the Born approximation has been noted in the literature; the Butler theory does not take into account the reaction of diverse emergent waves. The most important wave is that of the elastic diffusion wave of the incident nucleon. After a general discussion of the question, formulas are established which take into account the elastic diffusion wave. The forms $l = 0$ and $l = 1$ are calculated in some definite examples by supposing that the elastic diffusion wave is purely "potential." In the majority of cases, the angular distributions are about the same as in Butler's theory, but values two to six times weaker were found for the maxima of the effective cross sections. The effect of the reaction studied here can be greatly stimulated by augmenting by 25 to 100 the nuclear radius r_0 used in Butler's formula. (tr-auth)

1699

POLARIZATION IN THE REACTIONS (d,p) AND (d,n). J. Horowitz and A. M. L. Messiah (Centre d' Études nucléaires, Saclay, France). J. phys. radium 14, 731-2 (1953) Dec. (In French)

By using the calculations and notations from the preceding article, the effect of polarization which results from the emission of protons in (d,p) reactions is evaluated. (J.S.R.)

1700

NUCLEAR REACTIONS PRODUCED BY THE BOMBARDMENT OF BORON BY LOW ENERGY ALPHA-PARTICLES. E. S. Shire, J. R. Wormald, G. Lindsay-Jones, A. Lundén, and A. G. Stanley (Cavendish Lab., Cambridge, England). Phil. Mag. (7) 44, 1197-1212(1953) Nov.

Boron targets have been bombarded by He nuclei of en-

ergy between 1 and 2 Mev. Resonances for production of γ rays and protons from the reactions $B^{10}(\alpha,p)C^{13*}$, of protons from $B^{10}(\alpha,p)C^{13}$, and of deuterons from $B^{10}(\alpha,d)C^{12}$ were observed at 1.13, 1.24, 1.39, 1.51, 1.64, 1.68, and 1.83 Mev. Resonances for neutrons from the $B^{10}(\alpha,n)N^{13}$ reaction were detected at 1.51, 1.64, and 2.05 Mev. Angular distributions of the particles emitted were measured at 1.13, 1.51, 1.64, 1.68, and 1.83 Mev and spins and parities of 4^-, 3^-, 4^+, 4^-, and 4^+ tentatively assigned to the corresponding N^{14} levels. Spins and parities of $^3/_2^-$ and $^5/_2^+$ were confirmed for the second and third excited levels of C^{13}. Reaction cross sections and reduced level widths were obtained for α-particle energies of 1.51 and 1.64 Mev. A resonance in the $B^{11}(\alpha,p)C^{14}$ reaction was found at 1.58 Mev α-particle energy. (auth)

1701

THE ANGULAR DISTRIBUTION OF THE α-PARTICLES FROM THE $^7Li(p,\alpha)$ REACTION. D. K. Cartwright, L. L. Green, and J. C. Willmott (Univ. of Liverpool, England). Phil. Mag. (7) 44, 1307-8(1953) Nov.

The angular distribution of α particles from the $Li^7(p,\alpha)$ reaction is given by $\gamma(\theta) = A90(1 + \cos^2\theta + B\cos^4\theta)$. Experientally determined values for A and B are presented for proton energies near 600, 700, and 800 kev. The probable errors are smaller than the results of previous work. (K.S.)

1702

THE ANGULAR DISTRIBUTION OF LONG-RANGE ALPHA PARTICLES FROM THE PROTON BOMBARDMENT OF ^{15}N. A. V. Cohen and A. P. French (Cavendish Lab., Cambridge, England). Phil. Mag. (7) 44, 1559-68(1953) Nov.

The angular distribution of long-range α particles from the reaction $N^{15}(p,\alpha)$ has been investigated over the range 230 to 960-kev proton energy. It is found that the levels in O^{16} formed by resonant capture of protons of energy 340 and 1050 kev have spin and parity (0, +) and (1, –) respectively. Interference effects in the angular distribution caused by these two levels have been observed, but the phase differences necessary to account for these effects are not in full agreement with those predicted from modern dispersion theory. (auth)

1703

EXTERNAL (DIFFRACTION) GENERATION OF PARTICLES BY NUCLEAR COLLISIONS. I. Ya. Pomeranchuk and E. L. Feinberg. Doklady Akad. Nauk S.S.S.R. 93, 437-41(1953) Nov. 21. (In Russian).

At high energies, the collision of nuclear-active particles will give rise to new particles. The conditions of the reaction are derived, and the energy thresholds shown for high meson energy, low impact energy, and reactions outside the nucleus of the particles. Diffraction waves are formed by the reaction of the particles. (J.S.R.)

1704

THE EXCITATION FUNCTION FOR THE REACTION $^9Be(p,p2n)^7Be$. D. C. Salter and L. Bird (Atomic Energy Research Establishment, Harwell, Berks, England). Phil. Mag. (7) 44, 1305-6(1953) Nov.

An excitation function curve has been obtained for the $Be^9(p,p2n)Be^7$ reaction, for proton energies between 40 and 160 Mev. The curve is in excellent agreement with previous work of Randle, Dickson, and Cassels (Phil. Mag. 42, 665 (1951)). (K.S.)

1705

ANGULAR DISTRIBUTIONS AND YIELD OF THE $^{13}C(d,p)^{14}C$ REACTION. B. Koudijs, F. P. G. Valckx, and P. M. Endt. Physica 19, 1133-9(1953) Nov. (In English)

Angular distributions have been measured of long-range protons from the $C^{13}(d,p)C^{14}$ reaction at six deuteron energies between 0.30 Mev and 0.65 Mev. Protons were detected using nuclear emulsions. The target consisted of a thin layer of almost pure C^{13} on a thin Al backing. The experimental angular distributions agree surprisingly well with Butler's theory (for $l_n = 1$), which seems to indicate that even at these low deuteron energies the $C^{13}(d,p)C^{14}$ reaction proceeds predominantly by stripping. The yield in the forward direction ($\theta = 0°$) also was measured for deuteron energies between 0.25 Mev and 0.675 Mev at 25 kev intervals and for $\theta = 120°$ between 0.50 Mev and 0.70 Mev at 10 kev intervals. Use was made of a thin crystal (NaI) scintillation spectrometer. Indications were found of a resonance at about 0.63 Mev. (auth)

1706

DYNAMIC TREATMENT OF THE FISSION OF HEAVY NUCLEI. S. Flügge and K. Woeste (Univ. Marburg, Germany). Sitzber. Ges. Beförder. ges. Naturw. Marburg 75, 46-53(1952). (In German)

The fission of heavy nuclei is described on the basis of the drop model. The potential energy terms E_c and E_s of the deformed drop are derived from a development of the spherical function in a purely statistical manner. The kinetic energy of the system and the motion equation are derived dynamically. The constants are expanded to terms of the 4th order. The threshold energies of U^{238}, U^{235}, Pu^{239}, Cm^{242}, and Cf^{244} are tabulated. (J.S.R.)

1707

THE $^{54}Fe(n,p)^{54}Mn$ REACTION. G. H. Stafford and L. H Stein (S. A. Council for Scientific and Industrial Research, Pretoria, Union of South Africa). Nature 172, 1103(1953) Dec. 12.

In order to substantiate previously reported production of Mn^{54} from Fe^{54} in a reactor, samples of Fe and S were irradiated, and the Mn^{54} separated. Results established that the activity is produced by fast neutrons on Fe^{54}. A half life of 324 ± 11 days and a γ energy of 825 ± 20 kev for the separated activity were obtained. Fast and thermal neutrons were present in approximately equal numbers, the flux of each being $1 \pm 0.1 \times 10^{12} cm^{-2} sec^{-1}$. The cross section for the production of Mn^{54} was calculated to be $11 \times 10^{-27} cm^2$. From the P activity produced in the S sample, a ratio of 14 to 1 for the cross sections of the $S^{32}(n,p)P^{32}$ and $Fe^{54}(n,p)Mn^{54}$ reactions was obtained. (J.A.G.)

1708

STUDY OF PHOTODISINTEGRATIONS WITH THE AID OF PHOTOGRAPHIC EMULSIONS. I. EXPERIMENTAL ARRANGEMENTS AND PRELIMINARY MEASUREMENTS. Raymond Chastel (Coll. de France, Paris, France). J. phys. radium 14, 707-16(1953) Dec. (In French).

The accelerator tube and the experimental arrangements for the irradiation of the photographic emulsions are described. The source of γ rays, made from a target of Li (evaporated in a vacuum) bombarded by protons, was studied. The efficiency of the target as a function of the proton energy was obtained by measurement of the photonuclear activation of Cu^{63} with the aid of an ionization chamber. The energy spectrum of the γ rays was verified and the angular distribution of radiation intensity determined. The effect of parasitic neutrons was measured. The conditions of irradiation, of development, and of the microscopic observation of the nuclear emulsions are specified. (tr-auth)

1709

ANGULAR DISTRIBUTIONS OF GAMMA RAYS FROM $^{19}F(p,\alpha\gamma)^{16}O$. J. E. Sanders (Cavendish Lab., Cambridge, England). Phil. Mag. (7) 44, 1302-3(1953) Nov.

Observations of the 935- and 1381-kev resonances of the reaction $F^{19}(p,\alpha\gamma)O^{16}$ have been made. Fitting the angular

γ distributions to $I(\theta) = 1 + a\cos^2\theta$ yields a value for a, in the 935-kev resonance, of 0.00 ± 0.05 for the 6.14-Mev γ_1 and 0.0 ± 0.1 for the 6.91- and 7.11-Mev $(\gamma_2 + \gamma_3)$. The angular distribution of the total radiation at the 1381-kev resonance is $I(\theta) = 1 - 0.06\cos^2\theta$, in good agreement with previous measurements. (K.S.)

1710

ENERGIES AND ANGULAR DISTRIBUTIONS OF NEUTRONS FROM $Be^9(d,n)B^{10}$. J. S. Pruitt, C. D. Swartz, and S. S. Hanna (Johns Hopkins Univ., Baltimore, Md.). Phys. Rev. 92, 1456-60(1953) Dec. 15.

The angular distributions of neutrons from $Be^9(d,n)B^{10}$, leading to the five lowest states of B^{10}, have been measured at a bombarding energy $E_d = 0.945$ Mev. These distributions are compared with previous data for $Be^9(d,p)Be^{10}$. In both cases there is evidence for the deuteron stripping process. Interpretation of the distributions is discussed. Excitation energies are obtained for the B^{10} states. (auth)

1711

NUCLEAR PHOTOPROTONS FROM SILVER AND BROMINE [BOMBARDED] WITH LITHIUM GAMMA RADIATION. Hermann Wäffler (Universität Zürich, Switzerland). Helv. Phys. Acta 26, 785-97(1953) Dec. (In German)

The total cross-section, the energy spectrum, and the angular distribution of protons ejected by Li γ rays in nuclear emulsions have been investigated. The average total cross section of the Ag and Br isotopes is found to be $\sigma(\gamma, p) = 3.6 \times 10^{-27}$ cm^2. This is of the same order of magnitude as the cross sections measured in nuclei with appreciably higher proton binding energies. The energy spectrum of the photo-protons shows a marked peak near the maximum energy (10 to 12.2 Mev). This peak corresponds to a fraction of $\sim 12\%$ protons of the total, which leave the residual nucleus near its ground state. The angular distribution of the photo-protons for this high energy group can be described by the expression $J(\Theta) = 0.186 + \sin^2\Theta\,(1 + 0.65\cos\Theta)$. If one tentatively ascribes the high energy group to a direct process as proposed by Courant, it follows that for nuclei with high proton binding energies (e.g., Cd^{113}, Sn^{117}, Sn^{118}), the experimental cross sections are about 20 times larger as the model of Courant predicts. (auth)

PARTICLE ACCELERATORS

1712

PERIODIC ELLIPSE OF THE STRONG-FOCUSING EQUATION. B. C. Carlson (Princeton Univ., N. J.). Phys. Rev. 92, 839-41(1953) Nov. 1.

Free betatron oscillations in a strong-focusing synchrotron are given by the equation $d^2x/d\theta^2 + n(\theta)x = 0$. With the length of each sector $\Delta\theta = \nu$ and $n(\theta)$ periodic in 2ν, suitable transformations are given which describe an ellipse with its center at the origin of phase space. The continuous history of a point in phase space can therefore be described as motion on an ellipse whose shape and orientation change periodically with period $n(\theta)$. (K.S.)

RADIATION ABSORPTION AND SCATTERING

1713

PARAMAGNETIC SCATTERING OF NEUTRONS BY RARE EARTH OXIDES. W. C. Koehler and E. O. Wollan (Oak Ridge National Lab., Tenn.). Phys. Rev. 92, 1380-6(1953) Dec. 15.

The magnitude and angular dependence of the paramagnetic scattering of neutrons has been studied for the trivalent ions in the rare earth oxides, Pr_2O_3, Nd_2O_3, and Er_2O_3. These rare earth ions have large angular momentum contributions to their magnetic moments, and one object of the investigation was to obtain a better understanding of the magnetic scattering in such cases. The angular distribution of the scattering for samples at room temperature is compared with the theoretical results of Trammell (following abst.). The calculations based on screened hydrogenic wave functions give results in reasonably good accord with the measurements, when the screening constant is taken as an adjustable parameter which is then determined, within limits, by the data. Scattering measurements were also made at liquid N and liquid H temperatures, and within a few percent no changes and, hence, no crystalline field or exchange effects were observed. (auth)

1714

MAGNETIC SCATTERING OF NEUTRONS FROM RARE EARTH IONS. G. T. Trammell (Oak Ridge National Lab., Tenn.). Phys. Rev. 92, 1387-93(1953) Dec. 15.

The differential cross section for the magnetic scattering of thermal neutrons by paramagnetic rare earth ions is derived theoretically, assuming that the ions have Russell-Saunders coupling and are in the Hund ground state. Satisfactory agreement with the measured cross sections of Er_2O_3 and Nd_2O_3 is obtained using a hydrogenic radial wave function with $Z - S \approx 23$ and 20 for Er^{+3} and Nd^{+3}, respectively. (auth)

1715

GENERALIZED VARIATIONAL EQUATIONS FOR THE SCATTERING OF ELECTRONS BY HYDROGEN ATOMS. M. M. Gordon and J. G. Jones (Univ. of Florida, Gainesville). Phys. Rev. 92, 1428-33(1953) Dec. 15.

Generalized variational equations are derived for calculating the elastic and inelastic scattering amplitudes associated with the scattering of electrons by H atoms. The derivation of these equations is such that no unnecessary restrictions are imposed on possible trial wave functions. Two equivalent formulations are given: one involving the use of symmetrized wave functions; the other involving wave functions of the conventional (Mott and Massey) type. For trial wave functions consisting of only the incident wave (multiplied by a H eigenfunction), these variational equations yield the same results as are obtained by the approximations of Born and Oppenheimer. Various calculation procedures are discussed. In an appendix, it is shown that the Hulthèn variational equation for the scattering phases is a special case of the Kohn variational equation for the scattering amplitude. (auth)

1716

NEUTRON ABSORPTION AND SCATTERING BY HAFNIUM. L. M. Bollinger, S. P. Harris, C. T. Hibdon, and C. O. Muehlhause (Argonne National Lab., Lemont, Ill.). Phys. Rev. 92, 1527-31(1953) Dec. 15.

Thermal activation, thermal absorption, resonance scattering, resonance transmission, and multiplicity of capture γ rays have been measured for the stable isotopes of Hf. Isotopic assignments of the various resonance levels are presented which are consistent with all the data observed. Where possible, the level spacing is estimated. (auth)

1717

SCATTERING OF DEUTERONS IN HELIUM. T. Lauritsen and T. Huus (Inst. for Theoretical Physics, Copenhagen, Denmark) and S. G. Nilsson (Univ. of Lund, Sweden). Phys. Rev. 92, 1501-6(1953) Dec. 15.

The scattering of deuterons in He gas has been investigated at three angles in the energy range 1000 to 1200 kev. A pronounced resonance appears at $E_d = 1069$ kev, of width 35 kev (lab), which corresponds to the 2.187-Mev level of Li^6. It is established that the level in question has $J = 3$, even parity, and a reduced width of the order of the single-particle limit. The best fit to the observations is obtained with a channel radius of 4.0×10^{-13} cm, taking into account the effect

of the ground state, $J = 1^+$, which is assumed to have the same reduced width. A brief search, carried out at only one angle, revealed no further levels below $E_d = 2.0$ Mev. (auth)

1718

INELASTIC NEUTRON SCATTERING IN Al, Fe, Mg, AND Cu. Richard E. Garrett, Frank L. Hereford, and Billy W. Sloope (Univ. of Virginia, Charlottesville). Phys. Rev. 92, 1507-8(1953) Dec. 15.

Gamma rays emitted from nuclei excited by inelastic neutron scattering were observed. Pulse-height analysis of γ-ray scintillations which were coincident with scattered neutrons established γ lines corresponding to excited levels in the residual nuclei. Observed levels are reported for Al, Fe, Mg, and Cu. (auth)

1719

ANGULAR DISTRIBUTION OF γ-RADIATION FOLLOWING A DEUTERON STRIPPING REACTION. G. R. Satchler (Clarendon Lab., Oxford, England). Proc. Phys. Soc. (London) A66, 1081-92(1953) Dec. 1.

The angular distribution of γ radiation from a deuteron stripping reaction is given as a Legendre series $W(\theta) = \Sigma_\nu A_\nu P_\nu(\cos\theta)$. The coefficients are given in terms of the total angular momentum (orbital plus spin) of the captured nucleon and fully tabulated. Analysis of observed distributions can then test j-j shell model assumptions. Cascades are discussed, and a general theorem for the angular distribution of the nth radiation of a cascade is stated. Formulas are given relating the parameters of this paper to those used in the channel spin formulation. Their values when the nuclei obey L-S coupling rules are also given. Some other applications of the theory are indicated, and results of interest to experimentalists are summarized. (auth)

1720

THE APPLICATION OF VARIATIONAL METHODS TO SCATTERING BY IONS. II. THE DISTORTED WAVE APPROXIMATION AND THE 1s-2s EXCITATION OF HELIUM IONS BY ELECTRON IMPACT. B. H. Bransden, A. Dalgarno, and N. M. King (Queen's Univ. of Belfast, Ireland). Proc. Phys. Soc. (London) A66, 1097-1103(1953) Dec. 1. (cf. NSA 7-2904).

Wave functions determined by the variational methods of Hulthén and Kohn are employed in the calculation of the zero-order partial cross section for the process $He^+(1s) + e \rightarrow He^+(2s) + e$ by the distorted wave, the Born, and the Oppenheimer approximations. The inadequacy of the latter approximation near the threshold is disclosed. (auth)

1721

NUCLEAR SCATTERING OF HIGH-ENERGY NEUTRONS. T. B. Taylor (Cornell Univ., Ithaca, N. Y. and Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 92, 831-2(1953) Nov. 1.

Agreement between experimental neutron scattering experiments in Al, C, Cd, Cu, and Pb and results predicted by the optical nuclear model are compared. If K is the inverse mean free path for neutron absorption and k_1 is the magnitude increase of the propagation vector of the neutron upon entering the nucleus, then an assumed value of 1.25 for k_1/K at 85 Mev yields agreement within experimental error in the total cross section for the energy range 65 to 400 Mev. (K.S.)

1722

TIME-DEPENDENT QUADRUPOLE INTERACTION IN ANGULAR CORRELATION OF NUCLEAR RADIATION. I. Cd^{111}. P. B. Hemmig and R. M. Steffen (Purdue Univ., Lafayette, Ind.). Phys. Rev. 92, 832-3(1953) Nov. 1.

The influence of viscosity on the directional correlation of γ rays from Cd^{111} was investigated according to the theory proposed by Abragam and Pound (Phys. Rev. 90, 993(1953)) for the case of liquids. The attenuation of the γ-γ correlation was measured in water-glycerine mixtures of different viscosity. The correlation was not attenuated by the addition of paramagnetic Fe^{+3} ions, and it is concluded that the attenuation is mainly due to the time-dependent quadrupole interaction, rather than magnetic relaxation phenomena. (K.S.)

1723

DIFFERENTIAL p-p ELASTIC-SCATTERING CROSS SECTION AT 144, 271, AND 429 MEV. J. Marshall, L. Marshall, and V. A. Nedzel (Univ. of Chicago, Ill.) Phys. Rev. 92, 834-5(1953) Nov. 1.

The differential p-p elastic scattering cross section at 90° barycentric angle has been determined at 144, 271, and 429 Mev and has been found to be constant with energy within experimental error. In addition, the differential elastic scattering cross section for 429-Mev protons on liquid H has been measured as a function of angle by a scintillation counter technique which counts both incident and scattered protons, individually. (auth)

1724

THE GIANT NUCLEAR DIPOLE RESONANCE. M. Ferentz (Argonne National Lab., Lemont, Ill.) and M. Gell-Mann and D. Pines (Univ. of Ill., Urbana). Phys. Rev. 92, 836-7(1953) Nov. 1.

It is shown that with a system of individual nucleons interacting via short-range, two-body forces part of the nucleon-nucleon potential can lead to an oscillation of a nucleus as a whole. The excited level corresponding to this oscillation lies at an energy $\hbar W = W_0 A^{-1/3}$ above the ground state. A rough calculation indicates $W_0 \approx 80$ Mev, a result which is in agreement with the experimentally observed position of the giant resonance. (K.S.)

1725

D,D NEUTRON SCATTERING AND POLARIZATION EFFECTS IN C^{12}. R. Ricamo (Swiss Federal Inst. of Tech., Zürich, Switzerland). Nuovo cimento 10, 1607-15 (1953) Dec. 1. (In English)

D,D neutron polarization has been established again by measuring the azimuthal dependence of the differential cross-section of C^{12}. Experiments allow assignment of a 20% lower limit for the polarization of 3.32-Mev neutrons, emitted at 45° from the deuteron direction for a deuteron energy of 610 kev. Measurements of the angular distribution of scattered neutrons at resonance energy $E_n = 2.08$ Mev permit the identification of the level as a D state ($J = \frac{3}{2}$ or $\frac{5}{2}$). At the energy $E_n = 2.20$ Mev, i.e., far from resonances, the angular distribution has the expected theoretical behavior for the potential scattering. The effect of polarized neutrons on the angular distribution near an isolated level of the $D_{\frac{3}{2}}$ type has been calculated. (auth)

1726

SCATTERING OF HIGH ENERGY NUCLEONS AND ELECTRONS BY CARBON. G. Z. Shah, N. J. Patel, and K. M. Gatha. (M. G. Science Inst., Navrangpura, Ahmedabad, India). Proc. Phys. Soc. (London) A67, 92-4(1954) Jan.

The nuclear model proposed by Jastrow and Roberts (Phys. Rev. 86, 1035(1950)) has been experimentally tested by the scattering of 345-Mev nucleons and 15.7-Mev electrons in C. Approximate agreement was found with suitable adjustment of the parameters. (K.S.)

1727

INELASTIC MAGNETIC SCATTERING OF NEUTRONS FROM A FERROMAGNETIC CRYSTAL. W. Marshall (Univ. of Birmingham, England). Proc. Phys. Soc. (London) A67, 85-91(1954) Jan.

The wave functions and energy eigenvalues of a ferromagnetic crystal at low temperature are obtained, assuming a model of two electrons localized on each atom. The results are applied to the problem of inelastic scattering of neutrons following Moorhouse (Proc. Phys. Soc. (London)

A64, 1097(1951)). The effect of assuming two electrons per atom is quite unimportant. However, a more realistic estimate of the exchange integral leads to narrower peaks than predicted by Moorhouse and therefore tends to make the effect easier to observe. (auth)

1728

THE PENETRATION OF ELECTRONS INTO LUMINESCENT MATERIAL. W. Ehrenberg and J. Franks (Birkbeck Coll., London, England). Proc. Phys. Soc. (London) B66, 1057-66 (1953) Dec.

The penetration of electrons of energies between 10 and 40 kev into a number of phosphors, and the extent of their scattering, is measured on microphotographs of the luminous region produced in the phosphor by a beam of electrons of less than 0.75-μ diameter. A description is given of the apparatus and of the electron optical system designed to produce the fine focal spot. The phosphors used in the experiment were single crystals of the Tl-activated iodides of K, Rb, and Cs, and of the tungstates of Ca and Cd, and a luminescent plastic. An attempt is made to account for the discrepancies in the electron ranges as found in the present experiments compared with those obtained by other methods. An estimate is made of the distribution in depth of the energy dissipation in a phosphor when bombarded by a beam of electrons. (auth)

1729

ATTENUATION OF GAMMA RAYS. II. TRANSMISSION VALUES FOR VARIOUS MATERIALS AND GEOMETRIES. Glenn H. Peebles (Rand Corp., Santa Monica, Calif.). J. Appl. Phys. 24, 1437-47(1953) Dec. (cf. NSA 8-683.)

A discussion of the effect of variation of the total absorption coefficient on γ-ray transmission probabilities is given, which leads to estimates of the build-up factors for material of arbitrary atomic number Z. Estimates are made of the photon and energy densities arising from a plane of sources, a line of sources, and a point source in an infinite homogeneous medium, where the material of the medium is (1) Fe and (2) Pb. (auth)

1730

PASSAGE OF HEAVY PARTICLES THROUGH MATTER. S. K. Allison and S. D. Warshaw (Univ. of Chicago). Revs. Mod. Phys. 25, 779-817(1953) Oct.

A comprehensive review of experiments on atomic penetration is presented. The scope of this review is limited to charged atomic particles passing through matter, excluding meson and electron experiments. (K.S.)

RADIATION EFFECTS

1731

RADIATION DAMAGE IN INSULATORS. W. Primak, L. H. Fuchs, and P. Day (Argonne National Lab., Lemont, Ill.) Phys. Rev. 92, 1064-5(1953) Nov. 15.

Changes in the properties of several important insulators, due to processes initiated by the passage of energetic neutrons, are reported. New information and an analysis of the annealing phenomena are presented for diamond, SiC, quartz, and vitreous silica. (K.S.)

1732

SPECIFIC IONIZATION PRODUCED BY POSITRONS AND ELECTRONS. R. R. Roy and M. Etienne (Univ. Libre de Bruxelles, Belguim). Nature 172, 953(1953) Nov. 21.

An investigation of the specific ionization by positrons and electrons in N_2 and A, using a fully automatic Wilson chamber, is reported. Rh^{102} prepared by bombarding Rh^{103} with fast neutrons was used as the source. (J.A.G.)

RADIOACTIVITY

1733

ON THE DISINTEGRATION OF RaB. Seizaburo Kageyama (Tokyo Univ. of Education, Japan). J. Phys. Soc. Japan 8, 689-96(1953) Nov.-Dec.

The disintegration of Pb^{214} was studied by a β-ray spectrometer, with coincidence counter techniques. The β-ray spectrum of Pb^{214} obtained was complex, consisting of two components with end point energies 590 ± 10 and 650 ± 10 kev. This result was also confirmed by coincidence measurements between the internal conversion electrons of the 242-, 295-, and 350-kev γ rays of Bi^{214} and the β rays of Pb^{214}, using a pair of 180° focusing spectrometers. The relative intensities of the two β-ray groups obtained was 5 : 4 in accord with the excitation probabilities given by Ellis, and also with the transition probabilities calculated from the γ-ray intensities obtained by Muller et al. Judging from these experimental results, the level scheme proposed by Ellis seems to be more plausible than that of Stern. (auth)

1734

SOME RESULTS ON THE NUCLEAR SPECTRA OF Rb^{86} AND Cs^{137}. Pierre Macq (Centre de physique nucléaire, Louvain, Belgium). Ann. soc. sci. Bruxelles 67, 309-17(1953) Dec. (In French)

The object of the present work is the experimental study of the β and γ emission spectra of Rb^{86} by means of a β spectrometer with "thin lens" and the angular correlation existing between the directions of the β and γ cascades in the disintegration of the nucleus. The weak β spectra of Cs^{137} were studied in the same manner. (tr-auth)

1735

UPON THE ATMOSPHERIC RADIOACTIVITY OF ATOMIC ORIGIN. Hubert Garrigue. Compt. rend. 237, 1232-3(1953) Nov. 16. (In French)

The radioactivity on Puy-de-Dôme and in the air above it was measured from Oct. 10, 1953, to Nov. 3, 1953. It was concluded that all radioactivity found was from cosmic radiation. (J.S.R.)

1736

EVOLUTION OF THE AMOUNT OF ATMOSPHERIC ARTIFICIAL RADIOELEMENTS IN THE PARISIAN REGION. Marcel Abribat and Jacques Pouradier. Compt. rend. 237, 1233-5(1953) Nov. 16. (In French)

The amount of radioactivity over the Parisian area increased with the Nevada tests of March to June 1953 and with the Russian tests in September. (J.S.R.)

1737

INVESTIGATION OF AN INVERSE β RADIOACTIVITY. Tovy Grjebine and Henri Laurent. Compt. rend. 237, 1226-8(1953) Nov. 16. (In French)

If the particles emitted during β radioactivity are not electrons, as generally accepted, but unstable bodies with properties different from that of electrons, one should be able to detect them by their capture by a large nucleus. The capture by Ag^{109} of part of the β radioactivity of I^{128} with the formation of Pd^{109} might show the existence of such a particle. The circulatory system in which I^{128} is formed and Ag^{109} is exposed to its radiation is described. No data have been obtained. (J.S.R.)

1738

STUDY OF THE RADIATIONS EMITTED BY I^{126}. N. Marty, H. Langevin (Coll. de France, Paris, France), and P, Hubert (Lab. de Synthèse atomique, Ivry, France). J. phys. radium 14, 663-71-71(1953) Dec. (In French). (cf. NSA 7-29 23).

The radiations emitted during the disintegration of I^{126} were studied by means of a spectrometer with magnetic lenses and an installation of scintillation counters. Two β^- and one β^+ emissions were found with energies of 1.255 ± 0.01, 0.87 ± 0.02, and 1.21 ± 0.05 Mev. Two γ rays of 386 and 670 kev with almost equal intensities

and an x ray arising from Te were observed. The x ray indicated the existence of two important electron captures. From coincidence measurements one could establish a scheme of coherent disintegration taking into account the spins and parities of the different levels. It was found that $J = 1^+$ for the ground state of I^{126}. (tr-auth)

1739

ON THE PSEUDOSCALAR INTERACTION IN β-DECAY. G. Alaga, O. Kofoed-Hansen, and A. Winther. Kgl. Danske Videnskab. Selskab, Mat. fys. Medd. 28, No. 3, 10p. (1953)

Assuming the β-decaying nucleon to move in a simple scalar potential, the Foldy-Wouthuysen transformation is used to obtain an equivalent nonrelativistic form for the pseudoscalar interaction. The effect of the recoil of the nucleus has been taken into account. The observed shapes of allowed β spectra permit an estimate of an upper limit to the pseudoscalar coupling constant, which is difficult to reconcile with the value derived from the analysis by Petschek and Marshak of the Bi^{210} spectrum. This conclusion is dependent on the assumption of a simple nuclear potential. (auth)

1740

NUMERICAL CALCULATIONS FOR THE ANGULAR DISTRIBUTION OF GAMMA RADIATION EMITTED BY ORIENTED ^{58}Co NUCLEI. J. A. M. Cox, S. R. De Groot, and Chr. D. Hartogh. Physica 19, 1119-22(1953) Nov. (In English)

The theoretical results for the angular distribution of γ radiation emitted by oriented radioactive nuclei are applied to the case of Co^{58} nuclei. The angular distribution function of the γ radiation has been calculated for an arbitrary degree of nuclear orientation and as a function of a parameter, which describes the character of the β^+ transition or the K capture preceding the γ transition. (auth)

1741

THE ANGULAR DISTRIBUTION OF GAMMA RADIATION FROM ORIENTED ^{60}Co NUCLEI AND THE INFLUENCE OF THE CHARACTER OF THE PRECEDING BETA-TRANSITION. J. A. M. Cox, S. R. De Groot, and Chr. D. Hartogh. Physica 19, 1123-6(1953) Nov. (In English)

Numerical values are given for the angular distribution of γ radiation emitted by oriented radioactive Co^{60} nuclei. The calculations have been performed for the case when the spin of Co^{60} has the normally accepted value 5, as well as for the case when the spin is 4. Numerical results are given for an arbitrary degree of orientation of the initial Co^{60} nuclei and, in the second case, as a function of a parameter which describes the character of the β transition preceding the γ transition. The numerical figures suggest a possibility of obtaining information on the β interaction from comparison with experimental γ-ray distributions. (auth)

1742

ENERGY LEVELS OF Ti^{48} FROM THE DECAY OF Sc^{49} AND V^{48}. H. Casson, L. S. Goodman, and V. E. Krohn (Argonne National Lab., Lemont, Ill.). Phys. Rev. 92, 1517-21(1953) Dec. 15.

The γ rays following the decay of Sc^{48} and V^{48} have been investigated by means of threefold coincidence techniques. In the case of Sc^{48}, it was found that within the limits of experimental error all of the decays occur via a three-γ cascade. In V^{48}, although the decay occurs primarily via a two-γ process, a small three-γ contribution was detected. By twofold coincidence measurements, the 2.2-Mev γ ray of V^{48} decay was found to be in cascade with the 0.99-Mev γ ray. Level schemes are proposed for both decays. (auth)

1743

DISINTEGRATION OF Ca^{47}, Sc^{47}, V^{48}, AND Rh^{100}. Luis Marquez (Univ. of Chicago). Phys. Rev. 92, 1511-16(1953) Dec. 15.

The disintegration of four radioactive isotopes has been investigated, with the following results: Ca^{47} decays by the emission of two β-ray groups with end-point energies and relative intensities of 685 kev, 81%; and 2060 kev, 19%. Sc^{47} decays by the emission of two β-ray groups of end-point energies and relative intensities of 280 kev, 28%; and 490 kev, 72%. V^{48} decays by the emission of one single positron group with end-point energy of 693 kev. Rh^{100} decays by the emission of five positron groups with end-point energies and relative intensities of 150 kev, 0.06%; 540 kev, 3.64%; 1260 kev, 12.8%; 2070 kev, 38.5%; and 2615 kev, 45.0%. Procedures for preparation and chemical purification of these nuclides are described; and also their other characteristics such as half lives, conversion electrons of associated γ rays, etc. (auth)

1744

THE PRODUCTION OF A SHORT-LIVED ACTIVITY BY IRRADIATION OF Pb WITH X-RAYS. J. M. Reid and K. G. McNeill (Univ. of Glasgow, Scotland). Proc. Phys. Soc. (London) A66, 1179-80(1953) Dec.

An isomer of Pb^{207} with 0.8-sec half life has been detected as a result of bremsstrahlung irradiation of Pb. Experimental evidence points to a (γ,n) reaction. (K.S.)

1745

THE DECAY SCHEME OF KRYPTON-83. P. Swinbank and J. Walker (Univ. of Birmingham, England). Proc. Phys. Soc. (London) A66, 1093-6(1953) Dec. 1.

The occurrence of a nuclear level preceding the 1.9-hr metastable state in Kr^{83} has been confirmed. The associated transition has been shown to be of magnetic dipole type of energy 51 kev and half life less than 5×10^{-8} sec. (auth)

1746

GAMMA-GAMMA ANGULAR CORRELATION IN Pd^{106}. E. D. Klema and F. K. McGowan (Oak Ridge National Lab., Tenn.). Phys. Rev. 92, 1469-72(1953) Dec. 15.

The angular correlation of the 624- and 513-kev γ rays and that of the 1045- and 513-kev γ rays of Pd^{106} have been measured with a coincidence scintillation spectrometer using NaI detectors. For a dilute Ru chloride aqueous solution source, the correlation function of the 624-513-kev cascade is $W(\theta) = 1 + (0.3456 \pm 0.0079)P_2(\cos\theta) + (1.109 \pm 0.012)P_4(\cos\theta)$; that of the 1045–513-kev cascade is $W(\theta) = 1 + (0.0921 \pm 0.0027)P_2(\cos\theta) + (0.0350 \pm 0.0092)P_4(\cos\theta)$. In each of the above functions, the finite angular resolution of the equipment has been taken into account. The measurement on the 1045–513-kev cascade establishes the spin of the 1550-kev level as 2 and gives the intensity of the electric quadrupole radiation as 4.24 ± 0.14% relative to the intensity of the magnetic dipole radiation in the 1045-kev transition. (auth)

1747

DECAY OF Ga^{66}. L. G. Mann, W. E. Meyerhof, and H. I. West, Jr. (Stanford Univ., Calif.). Phys. Rev. 92, 1481-9 (1953) Dec. 15.

Scintillation equipment consisting of a three-crystal pair spectrometer, two-crystal Compton spectrometer, and single NaI(Tl) and anthracene crystals used in coincidence have been used to investigate the decay of Ga^{66}. Gamma rays of 4.83 (2), 4.33 (4.5), 4.12 (1.5), 3.78 (2), 3.41 (3), 3.24 (2), 2.75 (22), 2.40 (2), 2.18 (6), 1.93 (3.5), 1.58 (<0.4), 1.37 (3), 1.04 (30), and 0.83 (1) Mev energy have been observed. (Intensities, given parentheses, indicate percent of Ga^{66} decay.) These are fitted into a consistent decay scheme in which Ga^{66} decays to levels in Zn^{66} at 4.83 (2), 4.33 (8), 4.12 (1.5), 3.78 (21), 3.41 (4), 3.24 (10), 2.75 (2), 2.40 (~0.5), 1.04 (<0.5), and 0 (56) Mev. (Branching intensities, given in parentheses, indicate percentages.) The β- and γ-ray

branchings have been used to assign possible spins and parities to the states involved. (auth)

1748

HALF-LIFE DETERMINATION OF Po^{210} BY ALPHA COUNTING. Mary Lou Curtis (Mound Lab., Miamisburg, Ohio). Phys. Rev. 92, 1489(1953) Dec. 15.

A half life of 138.374 ± 0.032 days for Po^{210} was determined by α counting a sample of approximately 0.5 mc over a period of 328 days. (auth)

SPECTROSCOPY

1749

Radiation Lab., Univ. of Calif., Berkeley

THE ALPHA AND GAMMA RAY SPECTRA OF Pu^{238}. Frank Asaro and I. Perlman. Nov. 25, 1953. 20p. Contract W-7405-eng-48. (UCRL-2419)

The α and γ spectra of Pu^{238} have been studied with an α spectrograph and γ scintillation and proportional counters. Alpha groups of 5.495 (72%), 5.452 (28%), and 5.352 Mev (0.09%) and electromagnetic radiations of 17 (13%), 43.8 ± 0.5 (0.038%), 99 ± 2 (0.008%), and 150 ± 2 kev (0.001%) were observed. Spins and parities are assigned to the energy levels, and the results are evaluated with respect to the developing theory and systematics of complex α spectra and excited states of even-even nuclei. (auth)

1750

Mo K AND U L X-RAY TRANSITIONS FROM SEPARATED ISOTOPES. George L. Rogosa and Guenter Schwarz (Florida State Univ., Tallahassee). Phys. Rev. 92, 1434-7 (1953) Dec. 15.

The K_α ($K \rightarrow L_{III}$, $K \rightarrow L_{II}$) x-ray lines of Mo and the L_{β_1} ($L_{II} \rightarrow M_{IV}$) and L_{α_1} ($L_{III} \rightarrow M_V$) x-ray lines of U have been measured from separated isotopes using a double-crystal x-ray spectrometer. The x-ray transitions were induced by radiative excitation from a W target x-ray tube. Intensities were measured with a 70-cm Kr-filled Geiger counter. No evidence of nuclear isotopic effects (hfs and isotope shift) on the x-ray levels was found in the measurement of these transitions. The K_α transitions from the separated isotopes Mo^{92} (95.5%), Mo^{95} (88.0%), and Mo^{100} (86.65%) in MoO_3 and the L_{β_1} and L_{α_1} transitions from the separated isotopes of U^{235} and U^{238} in U_3O_8 show no measurable shift in peak positions and no changes in line widths. The limit of an observable effect is 0.2 v for the Mo transitions and 0.4 v for the U transitions. (auth)

THEORETICAL PHYSICS

1751

A SCALAR REPRESENTATION OF ELECTROMAGNETIC FIELDS. H. S. Green and E. Wolf (Univ. of Edinburgh, Scotland). Phys. Proc. Soc. (London) A66, 1129-37(1953) Dec.

It is shown that in a region which is free of currents and charges, any electromagnetic field may be rigorously derived from a single, generally complex, scalar wave function $V(x,t)$. In terms of this function the momentum density $g(x,t)$ and the energy density $w(x,t)$ of the field may be defined in such a way that they are represented by expressions analogous to the formulas for the probability current and the probability density in quantum mechanics; in a homogeneous isotropic medium

$$g(x,t) = -\frac{1}{8\pi\mu_0 c}\left[V^*\nabla V + V\nabla V^*\right],$$

$$w(x,t) = \frac{1}{8\pi}\left[\frac{\epsilon_0}{c^2}VV^* + \frac{1}{\mu_0}\nabla V.\nabla V^*\right]$$

The densities defined in this way differ from those given by the usual expressions, but the choice is justified since the differences disappear on integration over any arbitrary macroscopic domain. (The corresponding Lagrangian densities differ by a four divergence.) When V is of the form $V_0(x)e^{-iwt}$, g is found to form a solenoidal field which is orthogonal to the co-phasal surfaces arg V_0 = constant. (auth)

1752

CHARGE RENORMALIZATION AND THE IDENTITY OF WARD. Gunnar Källén (Univ. of Lund, Sweden). Helv. Phys. Acta 26, 755-60(1953) Dec. (In English)

The importance of the identity of Ward for the consistency of the charge renormalization is pointed out. A proof of the identity is given without aid of perturbation theory. (auth)

1753

NONSYMMETRIC UNIFIED FIELD THEORIES. W. B. Bonnor (Univ. of Liverpool, England). Phys. Rev. 92, 1067-8(1953) Nov. 15.

Approximate solutions to Kursunoğlu's modifications of a nonsymmetric unified field theory (Phys. Rev. 88, 369 (1951)) are obtained. The static, spherically symmetric solution contains two arbitrary constants corresponding to mass and charge and suggests that some difficulty is encountered in sustaining an original assumption that mass is entirely of electromagnetic origin. It is concluded from the results of this investigation that the mass and charge of particles may be separately assigned and that charge may therefore exist unassociated with matter. (K.S.)

1754

YUKAWA FORCES WITH ADDED ATTRACTIONS. John M. Blatt and M. H. Kalos (Univ. of Illinois, Urbana). Phys. Rev. 92, 1563-6(1953) Dec. 15.

A "Yukawa potential" is defined here as the conventional second-order potential of pseudoscalar meson theory with pseudoscalar coupling, cut off by a hard repulsive core. Properties of the neutron-proton system at low energies are calculated, assuming that the interaction is the Yukawa potential with various additional spin-independent central wells. The results indicate that interactions of this type (including the Levy potential) do not give a satisfactory fit to the low-energy data. (auth)

1755

THE EQUATIONS OF MOTION IN EINSTEIN'S NEW UNIFIED FIELD THEORY. Joseph Callaway (Princeton Univ., New Jersey). Phys. Rev. 92, 1567-70(1953) Dec. 15.

It is shown that the field equations of Einstein's latest unified field theory do not lead to the Lorentz equations of motion for charged particles in an electromagnetic field, if these particles are considered to be singularities of the field. To a fourth-order approximation, the motion of such particles is not influenced by the electromagnetic field, no matter how much charge is placed on the particles. (auth)

1756

FIELD THEORY OF EQUATIONS WITH MANY MASSES. B. T. Darling (24 West 87 Street, New York). Phys. Rev. 92, 1547-53(1953) Dec. 15.

The field theory of many-mass equations is developed, with special attention to spin ½ and the operator of the author's previous paper (Phys. Rev. 80, 460(1950)) on the irreducible volume character of events. The field is assumed to interact with the electromagnetic field which is introduced in a gauge-invariant way. General expressions for the charge-current four-vector and the symmetrical energy-momentum tensor are derived and are shown to satisfy the appropriate conservation theorems. According to a theorem of Leichter, the general solution is shown to be a superposition of nonorthogonal mass states which are designated as the root fields. Nevertheless, the physical

quantities, such as the current four-vector, the energy-momentum tensor, etc., are shown to decompose into a sum over those of individual mass states but with an alternation of sign for consecutive roots. The Lagrangian takes the form of an alternating sum over the individual free-field Lagrangians for the mass states, plus the usual term $+(1/c)j_\mu A_\mu$ for the interaction with the electromagnetic field. The matter field may be quantized by treating the root fields as independent anticommuting fields. The transformation to the interaction representation is obviously unaltered and the charge and mass renormalization may be treated following Schwinger. To the order of approximation in Schwinger, these renormalizations are not affected. It would seem that these methods of quantization, together with the usual treatment of the electromagnetic field, are at variance with the manifest nonlocal nature of the theory for the irreducible volume character of events. (auth)

1757

ELECTROMAGNETIC EFFECTS IN TWO-NUCLEON SYSTEMS. Stanley Deser (Harvard Univ., Cambridge, Mass.). Phys. Rev. 92, 1542-7(1953) Dec. 15.

Corrections to the electromagnetic properties of two-nucleon systems are examined by means of the relativistic two-body equation. An effective addition to the potential is derived, which describes the properties of the system in an external electromagnetic field. In particular, the correction to the deuteron's quadrupole moment is evaluated to lowest order in the meson-nucleon coupling. The result, for pseudoscalar (pseudoscalar) symmetric theory, is $\Delta Q = -1.3 \times 10^{-28}(g^2/4\pi)$ cm^2. (auth)

1758

FREE ELECTRONS IN UNITARY QUANTUM ELECTRODYNAMICS. Hermann Kümmel (Freien Univ., Berlin, Germany). Z. Physik 134, 78-94(1952). (In German)

The operations of zero approximation, treated in the unitary theory, are discussed, and a practical general method for the calculation of the scattering cross section is indicated. The incorporation of absorbers causes no difficulty. The Møller and Rutherford scattering, the Compton effect, and the bremsstrahlung were calculated according to this method (without the hole theory). In place of the hole theory a redefinition of the measurement in the quantum theory was used; it also allows for pair production and annihilation. Variations of many-electron problems (in the scope of this measurement definition) are treated. (tr-auth)

1759

A THEORY OF A UNIFIED FIELD WITH $\Gamma_\mu \neq 0$. S. N. Bose. (Univ. of Calcutta, India). J. phys. radium 14, 641-4(1953) Dec. (In French)

The equations of a unifield field were established by varying an integral which satisfies the Hermitian postulate. The equivalence formula is obtained by the old theories, either with $\Gamma_\mu = 0$ or with $||\alpha_{\lambda\Gamma}|| = 0$ when $\phi_\lambda = 0$; ϕ_λ can be interpreted as a Lorentz force if $\alpha_{\lambda\Gamma}$ is taken as the components of the electromagnetic field. The equations derived with antisymmetric components take the Maxwellian form for a certain value of the constants. However, for another value, it is possible to have a field with any singularity. (tr-auth)

1760

CERTAIN CONSEQUENCES OF THE EXISTENCE OF THE $\underline{g}$ TENSOR IN THE AFFINE RELATIVISTIC FIELD. S. N. Bose (Univ. of Calcutta, India). J. phys. radium 14, 645-7(1953) Dec. (In French)

The relations in which only $\Gamma^\lambda_{\Gamma\gamma}$ and its derivatives exist are derived by starting with the conditions of integrability of the equations which the $\underline{g}$ tensor of the relativity theory satisfy. The number of independent relations among the elements of the field is much greater in the unit theory than in the theory of gravitation. (tr-auth)

1761

ADIABATIC NUCLEAR POTENTIAL FOR LARGE VALUES OF THE COUPLING CONSTANT. M. Cini and S. Fubini (Univ. of Tunin, Italy). Nuovo cimento 10, 1695-1703 (1953) Dec. 1. (In English)

A method for the calculation of the adiabatic potential between two fixed nucleons is proposed giving a sequence of approximations in which at each stage only a limited number of mesons and pairs is taken into account. By means of a variational principle the adiabatic potential is approximated with a sequence of fractions of polynomials in g^2, whose coefficients contain only the potentials calculated by Lévy and Klein with perturbation methods. The convergence of the sequence does not depend on the magnitude of the coupling constant and, when the limit exists, it is an analytic continuation of the series in powers of g^2 outside its radius of convergence. (auth)

1762

MASS QUANTIZATION AND ISOTOPIC SPIN IN NON LOCAL-FIELD THEORY. J. Rayski (Nicholas Copernicus Univ., Torun, Poland). Nuovo cimento 10, 1729-35 (1953) Dec. 1. (In English)

Starting from general remarks on the theory of fields, the local formulation of which seems to be insufficient, the author presents a non-local generalization of the Dirac equation that leads, by means of convenient supplementary conditions, to a mass spectrum for the particles of spin $\frac{1}{2}$. The analogies of this mass spectrum with those obtained form the Yukawa and Pais theories are discussed. (auth)

1763

REMARKS ON THE VALIDITY OF THE TAMM-DANCOFF METHOD. G. Morpurgo and B. F. Touschek (Univ. of Rome, Italy). Nuovo cimento 10, 1681-94 (1953) Dec. 1. (In English)

An example of a field which has already been investigated by Wentzel and Blatt is discussed in detail. The exact solution of the problem corresponding to the scattering of a meson by a nucleon is compared with that obtained by the first approximation of the Tamm-Dancoff method. It is found that this method leads to results, which, though better than those obtained in perturbation theory, are essentially qualitative. The disagreement is particularly strong if the coupling constant is nearly sufficient to give rise to bound states. (auth)

1764

ON THE SCATTERING THEORY OF RELATIVISTIC EQUATIONS. E. Corinaldesi (National Research Council, Ottawa, Canada). Nuovo cimento 10, 1673-80 (1953) Dec. 1. (In English)

Parzen's method of evaluating the phase shift at infinite energies is extended to the case when the potential has a pole at the origin. (auth)

1765

ON QUANTUM FIELD THEORY. I. EXPLICIT SOLUTION OF DYSON'S EQUATION IN ELECTRODYNAMICS WITHOUT USE OF FEYNMAN GRAPHS. E. R. Caianiello (Instituto Nazionale di Fisica Nucleare, Rome, Italy). Nuovo cimento 10, 1634-52 (1953) Dec. 1. (In English)

A compact, explicit expression is given for the term of arbitrary order in the power series expansion of Dyson's S-matrix, for any arbitrary scattering process. The expression thus found for S has a very high degree of symmetry (a fact which the Feynman graph technique could not reveal; our procedure is also free from several shortcomings of this technique), which suggests the existence in the theory of deeper properties. These will be studied in the continuation to this work.

1766

RIESZ POTENTIAL AND THE ELIMINATION OF DIVERGENCES FROM QUANTUM ELECTRODYNAMICS. L. S. Kothari (Cavendish Lab., Cambridge, England). Proc. Phys. Soc. (London) A67, 17-24(1954) Jan.

By using a modified definition of Riesz potential, it is shown that the divergences arising in quantum electrodynamics from (i) the point nature of charge, (ii) the electron self-energy, and (iii) the vertex part of a Feynman graph can be eliminated in a consistent way, without having to introduce any cutoff factors or auxiliary fields. (auth)

1767

INTERACTION OF GRAVITATION AND THE VACUUM OF PARTICLES. D. Ivanenko and A. Brodskii. Doklady Akad. Nauk S.S.S.R. 92, 731-34(1953). Oct. 1. (In Russian)

The interaction of gravitational fields with the vacuum of scalar or pseudoscalar particles (mesons) is shown. (J.S.R.)

URANIUM AND URANIUM COMPOUNDS

1768

URANIUM-235 THERMAL NEUTRON FISSION YIELDS. George W. Reed (Univ. of Chicago) and Anthony Turkevich (Argonne National Lab., Lemont, Ill.). Phys. Rev. 92, 1473-81(1953) Dec. 15.

The absolute yields of six nuclides in the thermal neutron fission of U^{235} have been determined to better than 6%, using fission counting and radiochemical techniques. The results are in good agreement with earlier determinations of lower accuracy. They support mass spectrometric indications of fine structure in the yield-mass curve in low-energy nuclear fission. (auth)

1769

THE MAGNETIC SUSCEPTIBILITY OF METALLIC URANIUM. L. F. Bates and D. Hughes (Univ. of Nottingham, England). Proc. Phys. Soc. (London) B67, 28-37(1954) Jan.

The magnetic susceptibility of a pure specimen of metallic U has been measured over the temperature range 15 to 920°C. It is proved that sudden changes in susceptibility accompany the α-β and β-γ phase changes at 660°C and 767°C, respectively. The results are compared with those of other workers, and the difficulties of providing an adequate explanation of the thermomagnetic behavior are outlined. (auth)